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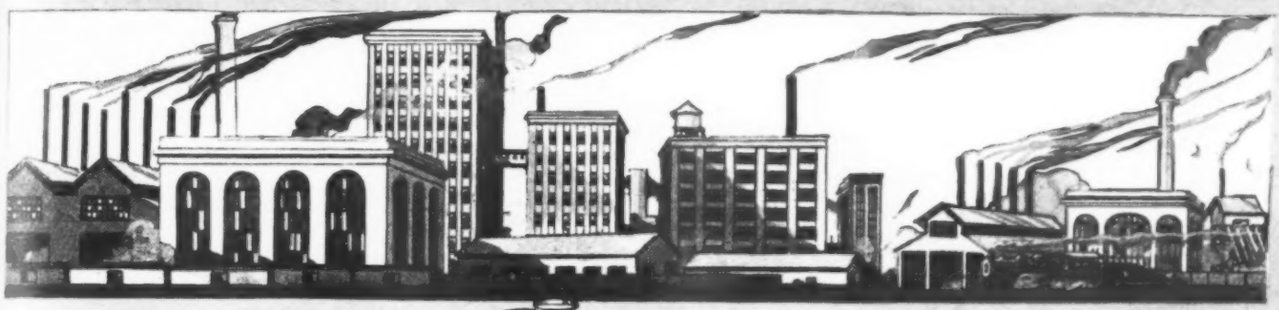

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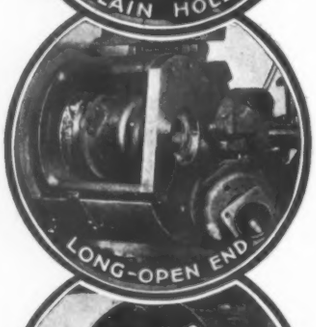

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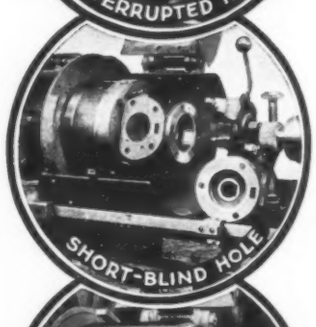

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Why not make America "Machinery Conscious"?

THE average American talks of this Machine Age without really being "machinery conscious." Few men in this country understand what machinery actually means in our present civilization. They take it apparently as something that just happened. That is because the machinery industries have not tried to make others understand what they are really doing for civilization.

President Coolidge, in a speech at Fredericksburg, Va. on October 19th, gave two simple illustrations of what machinery has done. He said:

"One man can now take from the seed as much cotton as would have been done by 28,000 without the cotton gin, and he can make as much yarn as would have been produced by 45,000 women on the hand spinning wheels of colonial days."

Isn't it about time for the various machine industries to bring out many similar facts to show the country what these industries have really done for the rest of humanity?

Whatever machines you make, your salesmen all have facts at their fingers ends, dealing with the extra amount of production made by your new types over those in most common previous use. But how many men know the relative efficiency of today's machines compared to the methods used in similar work in Colonial days?

And by the way, how would you like to go back to the machine tools of only 30 years ago in getting out your present production? Have you ever thought how much your own industry has progressed because of the progress in

MACHINE TOOLS

The Master Tools of Industry

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NATIONAL MACHINE TOOL BUILDERS' ASSOCIATION

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American Machinist

Editors
KENNETH H. CONDIT
FRED H. COLVIN

Volume 69 New York, November 22, 1928 Number 21

Depreciation as it Affects Costs

By Thos. B. Frank
Treasurer, The Cincinnati Planer Company

Fair selling prices can be set only when depreciation and interest on invested capital are taken into account

THE general subject of depreciation, important as it is and far reaching in its effects, is probably given less proper consideration than any other phase of accounting or business management. Can anything be more important for consideration than the gradual wearing out, both physically and economically, of plant buildings, machinery and equipment? Yet it is a fact that the accounting for this inevitable loss in value as well as utility is passed over lightly by many executives and boards of directors in shaping their company policies and in considering financial and profit and loss statements.

No attempt will be made in this article to discuss the principles of depreciation, as it is assumed that they are generally known, but rather to devote the space to the portrayal of several of the important depreciation factors that have a considerable bearing upon the financial and profit and loss figures resulting from the operation of a machine tool factory or any other plant of similar nature and manufacturing similar products.

Depreciation Defined

First let us consider two definitions: depreciation—which is the financial effect of deterioration, wear and tear, obsolescence and inadequacy, and invested capital—the net investment of physical and intangible property employed in the business enterprise, having two aspects, "cost" and "value." In speaking of depreciation the term will be used in accordance with the above definition as all-inclusive of its various elements. The "value" aspect of invested capital will be considered on its true merits.

Depreciation is charged off for the purpose of providing upon the books of account an allowance, or reserve if you choose to call it such, for the purpose of replacing the plant facilities when they are worn out or become obsolete or inadequate for further use. The practice that should be followed in making these charge-offs is to determine in a scientific manner a proper rate of depreciation and then make periodic charges to "costs of production" through the cost accounts. Depreciation is always an element of cost, a gradual using up of the plant facilities in the same manner as material is used up in producing the company's products.

The first step to consider in proper depreciation accounting is the establishment of a definite and accurate basis of valuation for the plant facilities, a basis that takes into consideration all contingencies with which the business is confronted and which it must meet in a highly competitive business cycle. In years past the basis of "cost of acquisition" had been considered by executives and accountants as being adequate for all purposes of industry. Many still adhere to this custom which, to say the least, is not serving its users faithfully at the present time. An example will bring out the point I wish to make.

Valuation of Equipment Should Allow for Cost of Reproduction

Consider a concern that has been in business since 1905, and has depreciated its machinery on a basis of 10 per cent per annum. Even today that plant will still have a large amount of equipment in everyday use that has been fully depreciated and charged off. What of the cost records of today? I will venture to state that the cost records today do not take into consideration the fact that this equipment is still being used and expended in the production of the company's products. No equipment can be depreciated beyond the 100 per cent point without some compensation being made for its rehabilitation.

The cost of production today does not take into consideration any charge for the use of the equipment that is fully depreciated and charged off on the books of account. Nevertheless, products are being manufactured with the aid of this equipment, and are being marketed in competition with like products manufactured under exceedingly different conditions—such as a modern plant, built and equipped, say in 1920 or subsequently. The difference is that the old plant would most likely have no charge made into its cost computations for depreciation, or at best a very small charge, while the competitive plant would have a very heavy charge based on present day values. Thus the distinction is made between the "cost of acquisition" basis and the "present value" or "cost of reproduction" basis.

The mere fact that any shop is operating with a lot of fully depreciated equipment should not in any way

govern the accounting for costs of production. Many of the concerns using such methods are riding along thinking that their costs are low. The same is true of those who take depreciation from that basis, having a low-cost plant and equipment built before the inflation period.

A company may have in its shop a mill costing $10,000 which was purchased in the year 1916. It has been depreciated at the rate of 10 per cent per annum, or should have been. In the year 1926, or in the year 1925, if a proper salvage value had been determined, this mill became fully depreciated. Therefore, in the year 1927 there could be no charge made against cost of production for depreciation on this piece of equipment, even though it was in constant use during every working day of the year 1927. How obvious it is that articles machined on this mill could not be costed properly without including a depreciation factor. How could correct selling prices be based upon such cost figures? How easy it is to lose sight of this very important element of cost if records are not kept in such a manner as to keep "values" current alongside of other current elements of cost. What a different cost figure is determined if a new mill is bought today at today's prices and the depreciation computed accordingly. Shouldn't all these factors be considered when bases for costs are set and company policies formed?

Profit Must Be Adequate

If a business is to continue, its stockholders and managers expect that business to earn a profit sufficient to provide for all such contingencies without the necessity of continually investing additional funds, which would under such conditions be invested at a continually decreasing return.

Then, is it not a most logical conclusion that depreciation must be based upon a value that will truly reflect the actual and true current costs of production, which should include the cost of the wasting and use of plant assets measured in present values? To include such depreciation computations in costs presents a continual true picture of actual present day costs upon which to base a selling price that will at all times assure the business of an adequate profit over and above the actual requirements of plant replacements and continuation. Any business that expects to prosper and grow must make such provision to assure its customers of a continuation of the service rendered, and the service that justifies its existence. From where else can it come but from proper selling prices, which in turn are based on proper costs intelligently determined?

The most practical method whereby this objective may be attained is to figure the depreciation computations on the present-day value of all plant facilities. Present-day values are today's market values found in today's markets, or the replacement value, to use a more common term.

There has been some misapprehension as to the exact meaning of the term "replacement value," but I feel that if it is considered to mean the "present-day value" such misapprehension would dissappear.

Comparatively simple accounting devices can be employed to record such values upon books of account and upon cost records, devices that will satisfy both the requirements of the Internal Revenue Department and the needs of the business. The process is not complicated nor difficult of execution once it is installed.

Table I—Depreciation Rates on Buildings

	Life Years	Rate Per Cent
Real Estate Improvements		
Roadways—		
Brick	8 to 10	10
Concrete	10	10
Macadam	6 to 7	15
Walks—		
Brick and cement	10	10
Wood—Charge to expense—		
Not over	2	50
Fences and Walls—		
Iron and wire	10	10
Wood or wood and wire, etc	2-3	50 to 33⅓
Fences made of these materials are usually in bad shape before the end of the second year or so. Therefore it would be more proper to consider all such outlays as charges to expense immediately. In no case depreciate for more than 2 or 3 years		
Railroad tracks and sidings	20 to 25	5 to 4
Railroad tracks must be kept in A-1 condition at all times. The repairs, replacements and general maintenance should be expensed in all cases. In some cases depreciation charged at the same rate as the buildings they serve would be entirely justified. All of the foregoing items are subject to the elements and this factor should be considered. All renewals, repairs, replacements, moving and all other such outlays should be charged to expense at once		
Buildings		
Concrete—		
Reinforced	30	3⅓
Concrete block, etc	20	5
Brick	20	5
Wooden	10	10
Steel frame—Corrugated iron walls, etc	7 to 8	15
Building Equipment		
Plumbing	10	10
The rough usage of plumbing and fixtures in machine shops and the frequent changes and moves warrant not over a ten-year life		
Electrical wiring	5	20
Due to the numerous changes that are constantly being made a five-year life is considered about normal		
Elevators—Freight and passenger	10	10
Sprinkler systems	20	5
Heating and ventilating—Same class as plumbing	10	10
All of these items are subject to many changes, replacements and maintenance charges, and constant moving around to suit new operating conditions. All changes, replacements and improvements should be charged to expense immediately		

After all, "money spent on inaccurate records is a dead loss," so why not have accurate records?

Present-day costs of labor and materials enter your costs without question. Why discriminate when it comes to the use of the present-day cost of using your plant and its equipment to complete the picture of cost of production upon which all selling and marketing policies are based?

Once the present-day value basis has been determined and its merits proven in the individual case then the rates of depreciation can be properly considered. A scientific determination of proper rates is of just as much importance as the basis of value upon which the rates are to be applied.

In determining rates all the elements affecting the use of the plant facilities must be considered. First there is the actual wear and tear from usage. Then there is the element of obsolescence and also the element of loss of useful life from economic causes. A machine that is purchased new today may, in two or three years, be rendered obsolete by the invention or improvement of equipment that would make the comparatively new machine out of date and uneconomic to use. True, it may still be retained and used, but the economics affect-

ing its use would soon indicate its continued use as unprofitable. Depreciation rates should therefore take this into consideration.

After many months of work and research, and after considering all of these elements, a committee of the National Machine Tool Builders' Association has set up a schedule of depreciation rates that would provide adequate charges to costs for all classes of equipment in common use by the majority of machine shops and plants of a similar nature. In Tables I, II and III a summary of these rates is set forth.

The rates recommended are rates that will stand the test of the Income Tax laws and have been accepted by the Bureau of Internal Revenue in the settlement of a great number of tax cases. At the same time they are rates that will assure adequate allowances for cost finding purposes.

In connection with the keeping of adequate depreciation records it has been found desirable by the concerns wishing accurate information, to keep individual equipment records for all items of plant equipment. These equipment records or "plant ledgers" as they are sometimes called should record all facts pertaining to the item of equipment listed thereon; its cost, installation cost, probable life, depreciation rate, and all other facts pertaining thereto, such as a record of repairs and maintenance. They should also provide for the record-

Table II—Depreciation Rates on Machinery and Equipment

MACHINERY	LIFE YEARS	RATE PER CENT
Machines—		
Large—Heavy	10	10
Small—Light	8	12½
Automatic	6 to 7	15
It is obvious that the larger and heavier types of machines have a longer economic and useful life than the smaller and automatic machines. A shop that has a large number of automatic machines should charge a higher rate for those machines, as the actual wear and tear is much greater and the obsolescence is more acute. The heavier machines are not subject to the same degree of obsolescence as the smaller machines and the automatics. The three distinct classifications are therefore recommended for most machine shops		
A fourth classification, at a lower rate of 5 per cent or 7½ per cent, might be added to cover the extremely large machines found in a few of the shops making the largest type of equipment		
No rate of less than 10 per cent should apply to the general classes of machine shop equipment commonly in use in the majority of plants. The lower rate is the exception rather than the rule		
Motors, controllers and electrical equipment—		
Individual line motors, etc	10	10
Controllers	10	10
Cranes — Electric, overhead traveling cranes, and craneways, hydraulic, steam, etc. and lifting magnets	12 to 15	7½
Hoists—Jib cranes, hand cranes, electric and chain hoists, derricks, etc	6 to 8	15
SHOP EQUIPMENT		
Hangers, pulleys and shafting (Due to obsolescence*)	5	20
Furnaces and forges	5 to 7	20 to 15
Lockers, bins and benches—		
Wooden—Charge to expense	0	0
Steel—Of a stationary nature—not over	10	10
Shop office equipment	4	25
Shop office equipment is subject to unusually rough usage and depreciates very rapidly		
Blue printing machines and equipment	10	10
Breast drills and other electrically or automatically operated hand tools		
Should be charged to expense		

Table III—Depreciation Rates on Miscellaneous Items

	LIFE YEARS	RATE PER CENT
SMALL TOOLS		
Taps, reamers, drills, files, saws, chisels, chucks, etc.		
Should be charged to expense immediately as issued to shop		
DIES, JIGS, AND FIXTURES		
Should be expensed immediately. If advisable to capitalize they should be charged off over a period not to exceed three years, or spread over a certain number of machines that would be normal to build and ship in the three-year period		
PATTERNS AND DRAWINGS		
Should be expensed immediately. In cases where it is found advisable to capitalize, they should be spread over not more than a three-year period the same as dies, jigs and fixtures		
*Such obsolescence due to motorization of individual items of machinery.		
BELTING		
Belting should be charged off to expense at once in all cases		
POWER HOUSE EQUIPMENT		
Boilers, engines, generators—Composite rate	10	10
OFFICE FURNITURE AND FIXTURES		
Desks, chairs, and other furniture	7 to 10	15
Mechanical office equipment—Typewriters, adding machines, check writers, printing machines, etc.	3	33⅓
AUTOMOBILES		
Trucks—		
Heavy	4	25
Light	3	33⅓
Passenger cars		3 a month
AUTOMATIC SIGNAL SYSTEMS	7½	15
HOSPITAL EQUIPMENT	5 to 7	20 to 15
RESTAURANT EQUIPMENT—FIXED	5 to 7	20 to 15
This classification should include only such items of equipment as are fixed, such as ranges, boilers, tables, refrigerators and the like. Dishes, pots and pans and other table and kitchen ware should be charged to expense		

ing of both present-day values and the cost of acquisition.

Another feature to consider along with the accounting for depreciation is the maintaining of depreciation allowances or reserves in liquid form. In most cases today the commonly designated "reserve for depreciation" is merely a book figure appearing upon the books and financial statements of the liability side as an offset to the plant asset accounts. It represents the accumulated charges made to costs over a period of time and is not in a form that can be drawn upon for disbursement. Most such reserves have been turned back into the plant in the form of inventories and other items that are not readily convertible into cash with which to purchase plant replacements when they are needed and for which purpose the depreciation reserve or allowance was created. In some cases these reserves have even been paid out as dividends.

The establishment of a method of setting aside as a replacement fund an amount of cash or negotiable investments equal to the monthly or periodic charge-off for depreciation would certainly maintain the reserve in a form that could be disbursed for the actual replacement of the plant assets when the time came for such replacements. The old story of "no funds available to buy new equipment" would then no longer be an argument of the purchasing agent, and would prove a boon to all machinery and equipment manufacturers. The beauty of this arrangement is that it is simple and can be put into effect in every business.

Why not rechristen the old "reserve for depreciation" with a name more descriptive of its actual purpose and intent, such as "equipment replacement fund?"

Paying for Advice

"MR. HOLLAND, I've just come to the conclusion that I'm the town's prize fool." It was Tom Hudson, the proprietor of a contract shop in town, and a good one, too. Bert Winters was also in the shop.

"Guess most of us feel that way at times, Tom, but few of us ever tell the other fellow about it. What's it all about?"

"It's just because I've been easy enough to give away every year hundreds of dollars worth of information that should have been paid for. It isn't that I want to be mercenary, or that I wouldn't gladly help out any poor devil who didn't have the money. But I, and most of us mechanics, spill all we know, without more than a 'thank you' at the best, whenever anyone comes around and asks advice on any mechanical problem."

"Just why the outburst now?" spoke up Bert Winters.

"Well, Bert, it's this way. I'm planning to build a new shop next year. So I dropped in on Frank Fuller, the architect, to ask a few questions about buildings and how you go about it. He's been in to see me a dozen times about his car and the pumping plant he put in two years ago.

"When he found that I was figuring on building he trots out a blank for me to sign that says I agree to pay him twenty-five dollars retaining fee for preliminary consultation before any plans are drawn or even started. He looked a bit funny when he shoved it under my nose to sign, but he didn't weaken—and I sort of admire him for it. I find it's customary with them all."

"And then what, Tom?" asked Holland.

"There's only one answer, Mr. Holland. I'm going to play Fuller's game myself. The next bird that blows in here to get my advice on his new pump, or any other designs, pays for it—at about ten dollars an hour. When I get my nerve up I may charge more."

"Sounds a bit high-hat to me, Tom," spoke up Winters.

"Both of you know that we mechanics are prize idiots when it comes to anything but working in iron and steel. We just hand over our shirt to anyone who asks for it unless he wants it tin plated; if he does, we charge him half price for the plating," continued Hudson.

"Tom, there's a lot to what you say about mechanics being free with their advice and experience," admitted Winters. "I've thought about that very thing many a time, but I never got my nerve up to the point of charging for advice unless I could work it in with the job. But frequently the job goes to the other fellow. Perhaps you're right, Tom, but I'd be afraid I'd lose work by it."

"We lose it anyhow if the other fellow bids lower—even when the customer uses our advice about the machine. I'm getting to believe that they'll think more of me, and the advice too, if they pay for it. How about it, Mr. Holland?"

"You two have made out quite a case. People seldom fully appreciate what they get for nothing.

"Good mechanics are very apt to give very freely of the information they've gained by years of experience. Much of it, at least, ought to be paid for, and probably will be if payment is requested. There's been so much of it given for the asking that customers have got the habit of expecting it. I'd suggest that you use a little diplomacy in springing that new payment plan, though, Tom."

"Diplomacy or no diplomacy, they all get a bid to pay me or they don't get my valuable advice, Mr. Holland. I'm through broadcasting my information gratis."

"Think you're right in theory, Tom," added Winters, "but I want to see someone else try it out first. I'm afraid my pocketbook isn't strong enough to bridge the gap."

Executives are invited to discuss the problem involved in the foregoing case. They are also urged to use this department to air their own problems. A letter to the Executive Forum Editor is all that is needed.

EXECUTIVE FORUM

Discussion

Profits for Builder and User

Purchasers of high-production machinery seem to forget the long years of toil, effort and experience necessary on the builder's part to construct the machine. As long as the buyer will receive a bigger return from the use of the machine than he can get any other way, the builder is justified in cashing in on the experience he gained while he was struggling and working to make the machine a success.

Primarily, the buyer should be concerned only with what the machine is worth to him. From production and sales analyses he can investigate the matter, and then form a decision whether or not the purchase of the machine at the buyer's price will be justified.

—FREDERICK KAMPMEIR.

The machine builder is essentially an engineer in that his own product is founded upon ideas, skill, and knowledge. Improved machinery is an expression of one of the highest forms of engineering. We do not measure the value of an engineer's dollar by the bulk or weight of the machine he offers, by the color and finish, or by the height or width or floor area covered, but by the output.

If the dollar invested with the engineer can give the buyer twice the production he can get out of the old machine, why should he be concerned as to how much physical material and work goes into it? What if it is only 10 per cent of the selling price? There is only one thing that justifies the price of any production machine, and that is its output. If it's anything but output that the buyer wants, there's the second-hand dealer for bulk, the paint shop for finish, and the junk pile for noise. If he wants production there is the new machine at the price the manufacturer asks.

—JOHN M. VANTIER.

How Much Shall We "Doll Up" the Plant?

The benefits derived from making the surroundings of a plant beautiful and attractive are hard to calculate, and cannot be expressed in terms of money. Those who have tried to make things pleasing to the eye quite generally agree that it pays. An outstanding example is the way in which a beautiful oasis was made out of the desert at Needles, Arizona, and the labor turnover greatly reduced.

This point of labor turnover is probably where the greatest return is received from making plants as attractive as possible. The example set by the plant is carried home by many of the employees, and attractive yards and gardens are the result. An employee who works in an attractive plant and goes home to a pretty place upon which he has spent many hours of happy work, hesitates a long time and weighs conditions carefully before he makes a change.

A great deal can be accomplished at a minimum of expense by beginning in a small way, and building up from year to year. Almost every plant can do something, although at first sight some cases seem to be hopeless. One such case was a plant in the heart of a city. Not a square foot of ground was available for a blade of grass or a flower, but the female employees accomplished wonders with window boxes and with flowers in pots. Even though no financial benefits may be received, it certainly seems worth while to remove some of the drab and ugly sights.

—C. J. MORRISON.

Making the Most of Floor Space

Since the Young Company has decided upon a new production program, it is necessary to determine the maximum capacity of each machine. The slowest machine determines the maximum productive capacity of the shop, and determines whether or not new machines are required. The next step should be to arrange the machines so that the operations will be in sequence and to group them so as to make the best use of the floor space. Groups can be successfully operated when the machines are equipped with power feeds.

Since the time taken in walking to and from the machines has a direct bearing on production, it is essential that they be grouped as close together as practical. It is surprising how little room is required in the average manufacturing plant. The groups themselves should be placed close together, so that little or no handling of material is necessary between them. After such a study as this, we are in a position to say how much floor space we actually require for a given production.

It has been my experience that too much floor space is a hindrance to production. Stock is placed on trucks or racks between operations and is thereby, in effect, placed in stock in an unfinished condition. A better plan is to crowd the machines together as much as practical so as to have a steady flow of production.

R. A. MAXWELL, *Canada.*

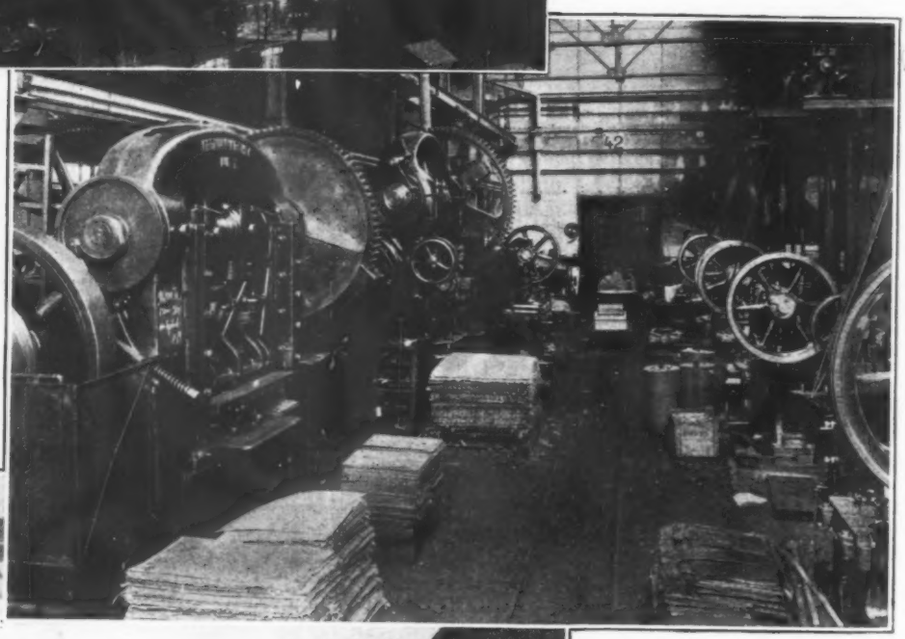
Next Week

When the Rush Comes

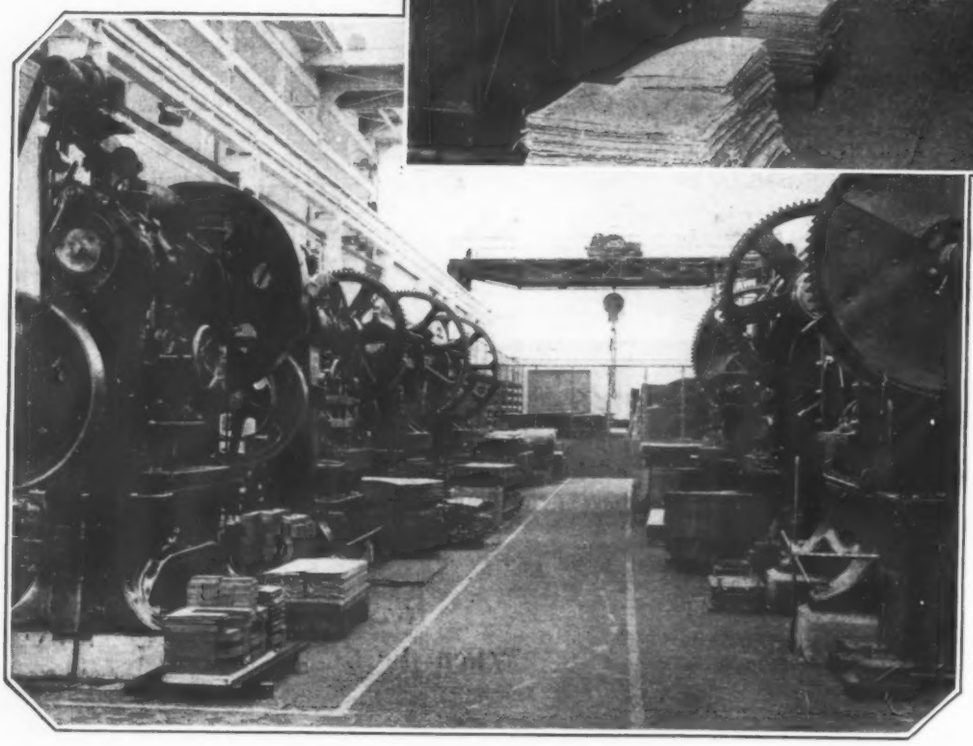
A Swiss Plant Specializing in Electrical Equipment

Photographs by courtesy of Brown, Boveri & Company

The new erecting shop shows a much more generous use of glass than is found in the older buildings

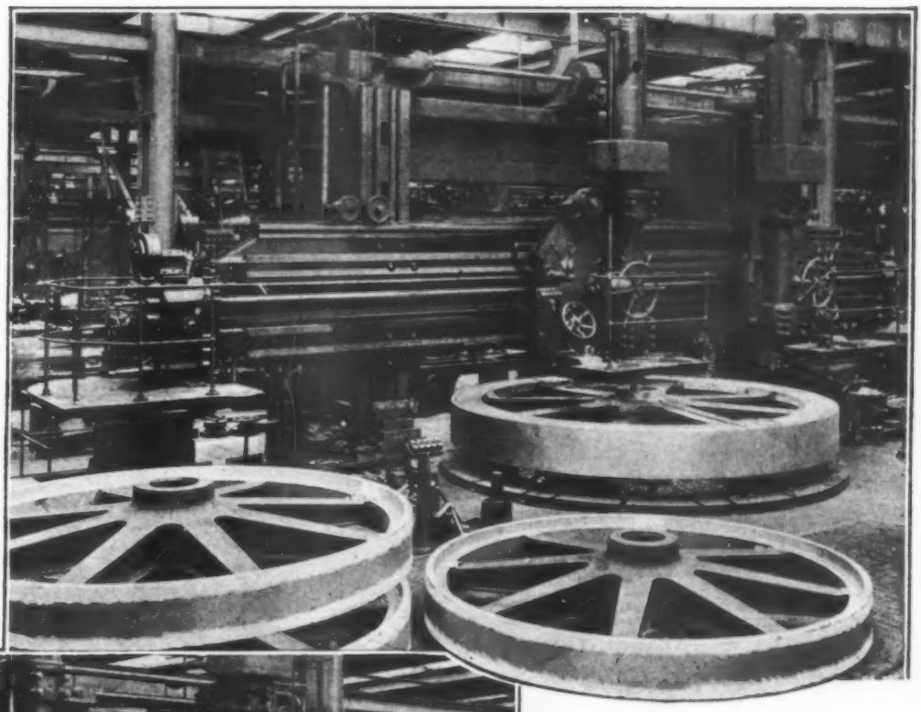


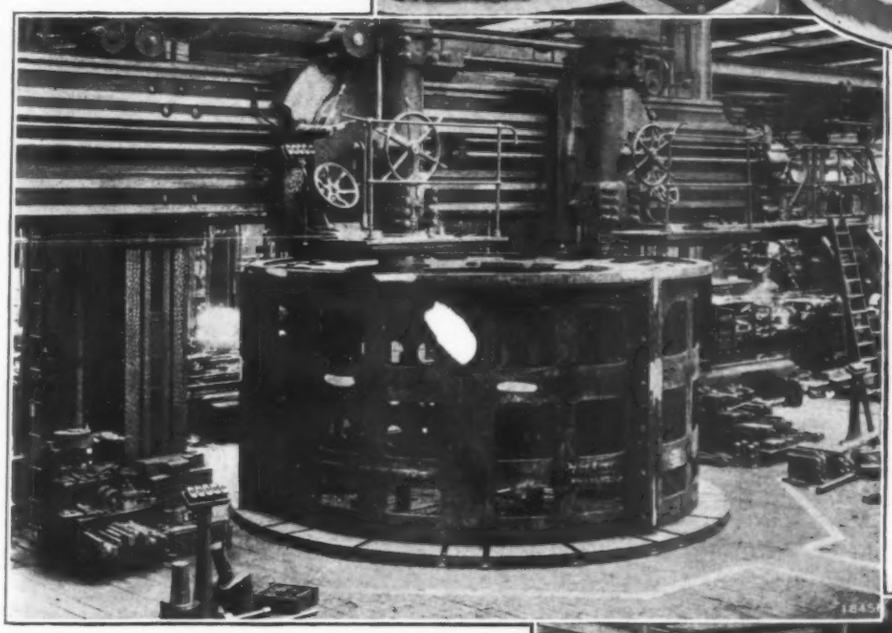
Bay where dynamo sheets are blanked. This shop is typical of the older type of construction with saw-tooth roof and few side windows



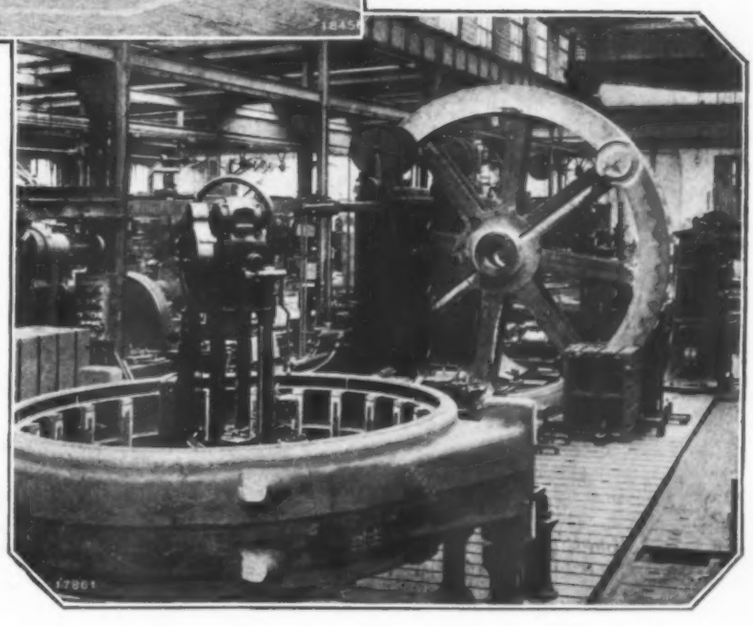
Another press department in a more modern building. This bay has crane service, adequate light and individually-driven tools. Note the wheel guarding

In the heavy machining department. A large German turning and boring mill with push-button control at several stations

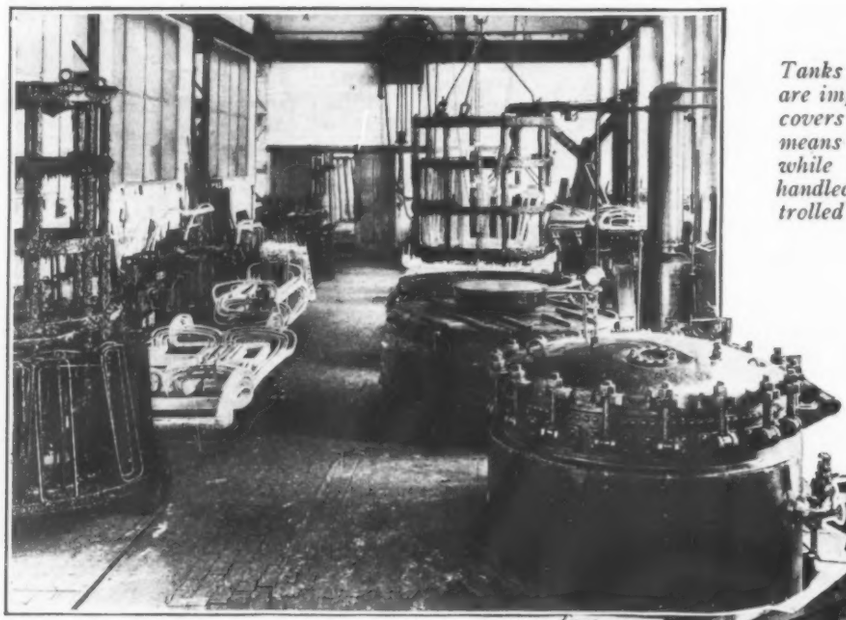




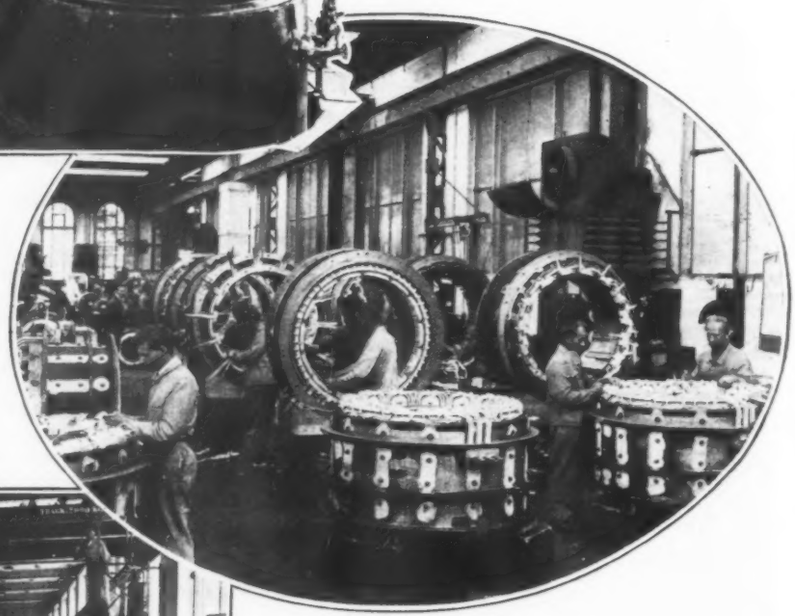
A big stator frame on the table of the boring mill. This shows the control in somewhat more detail



Two large dynamo parts on the floor plate. The machine at the left is portable

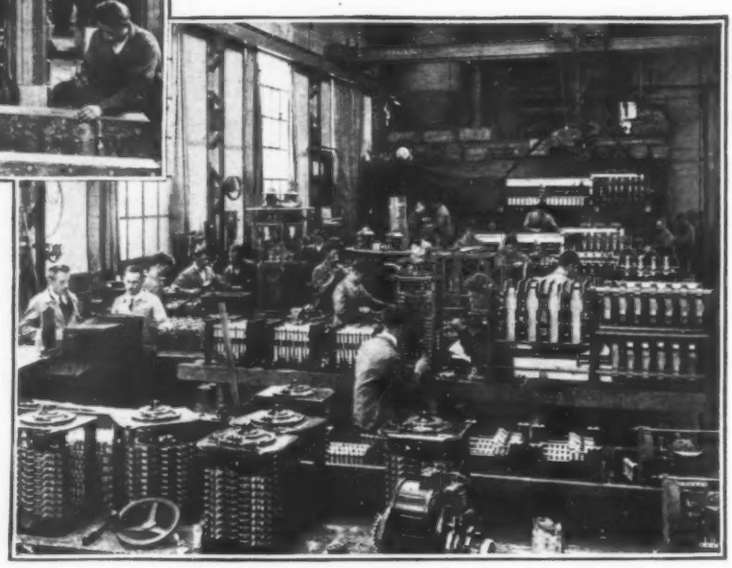


Tanks in which coils are impregnated. The covers are removed by means of a wall crane, while the racks are handled by a floor-controlled traveling crane



A bay in one of the older buildings where stators for single-phase locomotive motors are wound. Note the unit heaters

A modern bay devoted to the assembly of transformer cores for single-phase locomotives



Mounting of the various control apparatus for electric locomotives

Equipment Principles for Making Formed Wire Parts

By F. H. Mayoh

AS A PRELIMINARY to the study of any wire-forming work it is well to observe that even common straight forms of wire articles do not go into production ordinarily without the preparatory use of a machine to straighten the wire. Wire as it comes from the coil is passed through the machine so that the curve is taken out and any kinks are straightened. The machine usually cuts to length, also, producing straight wire rods as commonly used. The principle of a straightening machine often used for this purpose is shown in Fig. 1. The wire to be operated on comes from a coil held on a reel, and enters the left of the machine, passing through a straightening device which is driven by a belt on the pulley at the right. This straightener revolves as the wire is pulled through it, five contacts being made on the wire by adjustable dies. In a cutting-off type of machine the straightened wire passes out along the channel of the machine to the desired length, and a cutter at the head severs the wire to length. The wires are taken from this channel as they accumulate and are placed in forked retainers which provide a place to hold them for temporary storage until it is convenient to remove them. The various members of this machine are adjustable radially to accommodate different diameters of wire, and are adjustable longitudinally for various lengths of feeding through the machine.

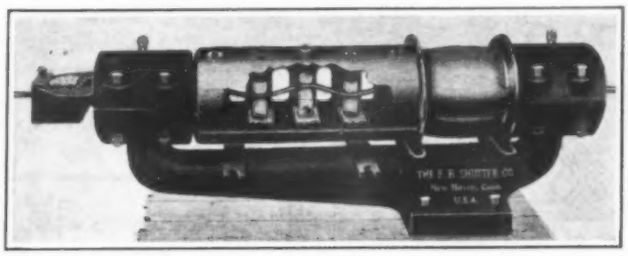


Fig. 1—Principles of a die-type of wire-straightening machine. The wire is drawn from a reel at the left of the machine. The straightening device at the center contains five adjustable dies through which the wire passes

For the straightening of the heavier sizes of wire, another type of roll machine is used. This differs considerably from the die-type of machine, although the general principles are the same. Mounted directly over the base of the machine is a set of five rolls through which the wire being straightened passes. These rolls are geared together so that they revolve positively. A corresponding set of rolls is set at right angles, and these are also driven together by gears. The combination of these two sets of rolls will take any kinks out of the wire as it passes through the machine. For the purpose of forming intricate shapes of small articles made from round, flat, and shaped wire, there have been developed a number of ingenious machines. In the machines, certain well defined movements have been established, and these form a basis that permits the incorporation of tools that will operate on the wire and make the desired bends to produce the parts. A machine of this nature is illustrated in Fig. 2. The machine as shown is tooled for making chains, but the general principles are the same for making other wire parts. At the left of the machine is a wire straightener in the form of a bracket with a set of rolls in a horizontal plane and one set in a vertical plane. The wire passes through these rolls, and is fed out and cut off to

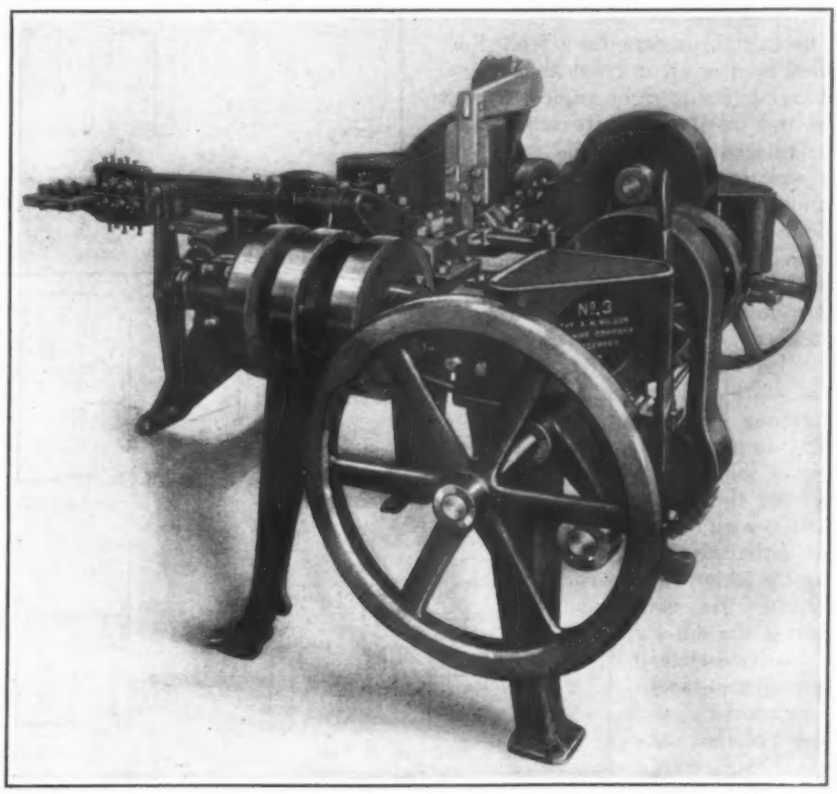


Fig. 2—A chain-making machine, which is also of the general type employed for the production of formed wire articles. The tools are operated on slides which are driven by cams. By changing the cams and slides a wide variety of parts can be made

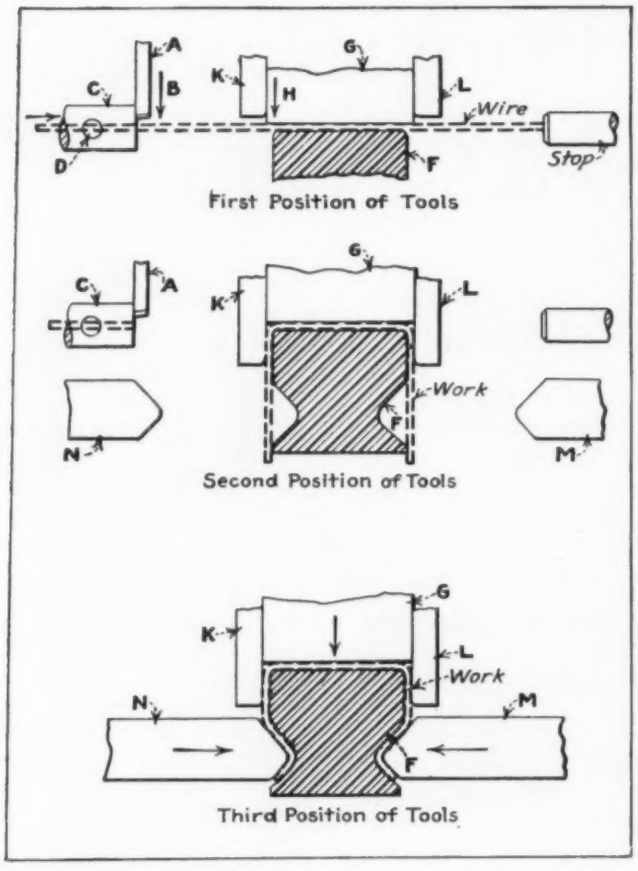


Fig. 3 — Tool arrangement for forming a wire retainer. These are all simple bends, and can be made by the slides acting from the four cam shafts in a horizontal plane

the desired length. The feeding is done by a feed slide, which is usually actuated by a lever or crank movement. There are generally four shafts at right angles to each other on the machine, and on these shafts are located the cams that move the various slides carrying the forming tools. When the wire is fed to the desired length and cut off, the forming slides, operated by the cams from the front, rear, and both ends, operate to make the various bends. Plungers from below or above the work are also employed to form the wire, or strip it off of the forming arbors, as desired. These plungers are operated by lever motion from cams on the side shafts. The formation of a wire retainer on one of these four-slide machines is shown diagrammatically in Fig. 3. The cutting tool *A*, operated from the camshaft, shears against the wire supporting bushing *C* while the wire is held in the bushing by the clamping pin *D*, and while the end of the cut-off is held in place against the die *F* by a presser foot *G*. The two slides *K* and *L* next feed forward and bend the wire around the arbor or die, as shown in the "second position of tools." When this operation is completed, the two slides *M* and *N* move in from the front and rear and complete the forming of the wire retainer. All slides now return to their initial starting position, and the work is stripped off of the arbor by the lowering of the latter into a sleeve, thus permitting the work to be pushed off by an ejecting finger.

The forming operations on a binder ring, such as employed in a loose-leaf book, are shown in Fig. 4 and 5. The various positions of the tools on the four slides are shown in Fig. 4. The wire is pulled from the reel and passes through the straightening rolls through the guide *B*, and clamped in the same manner as before. The slide *F*, the cutting-off tool *G*, and the two slides *J* and *K* operate in the direction of the arrow *E*, and the wire is formed as shown in the "first position of tools." The two slides, *J* and *K*, next move forward and bend the wire ends around the sides of the die. The ends of the wire lay over the half-circle shape *W*, which is part of the formed block *F*. In the third position of the tools, the two plungers *M* and *N* have come down, and they form the ends of the wire over these curves. In the fourth position of the tools the slides *P* and *Q* have moved in and completed the form around the block.

In Fig. 5, the forming tools are shown returned to their starting position by the action of the cams on the four shafts. In this case, the work has a tendency to cling to the slide *F*, and as this slide is returned the ejecting lever *R* knocks off the work, so that it drops

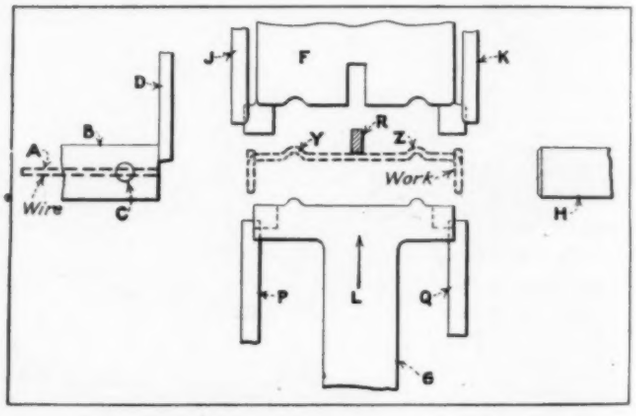


Fig. 5—Ejecting position of tools shown in Fig. 4

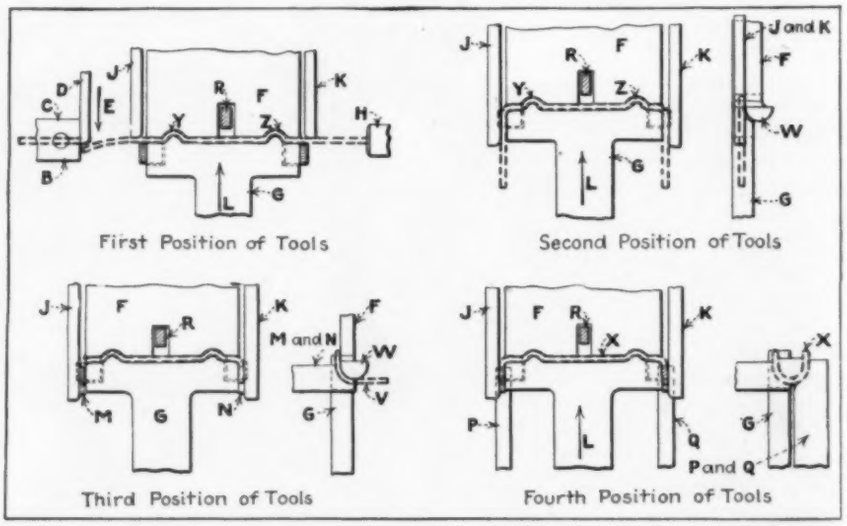


Fig. 4—Tool and slide positions for forming a binder ring. In addition to the bending done in a horizontal plane, the half ring is made by a slide action from a plunger moving down from above, and is completed by the movement of two additional slides from one side

through a hole in the bed of the machine into a receiving box on the floor.

It is apparent from these two examples of wire forming that a wide choice of applications may be had on the four-slide type of wire-forming machine. Modifications of cams are made to suit the particular application at hand, and the forming blocks or dies are grooved or formed to suit the shape of the wire.

Chain in a wide variety of shapes is made on modified types of slide and plunger wire-forming machines. Some of these embody twisting mechanisms, and others are of the plain link-forming type. Machines to make chain are sometimes fitted with attachments to limit automatically the size of the chain to predetermined lengths, with a certain definite number of links. In Fig. 6 are shown the principles embodied in the forming of a plain link chain. After the wire has been fed through the straightening rolls and passes through the feeding slide B, it passes through a holding clamp D, which grips the wire while it is cut off with a shear blade E. The wire is fed against the stop F. The arbor J, having the finished form of a chain link, is made as part of the slide K, which has both ends formed with a radius as shown at L and F, around which the first forming of the chain link is done. Slide K operates up and down on the guides M and T. With the arbor J at the highest point of its rise, the two forming plungers S and T are fed in the direction of the arrow, bending the wire as shown in the second position of the tools.

Previous to this end-forming operation, and before the wire is cut off, a pair of forming jaws, U and V, advance slightly and hold the wire against the arbor J, so that it will not fall out of place as it is cut off. After the end forming, these jaws advance and bend the wire

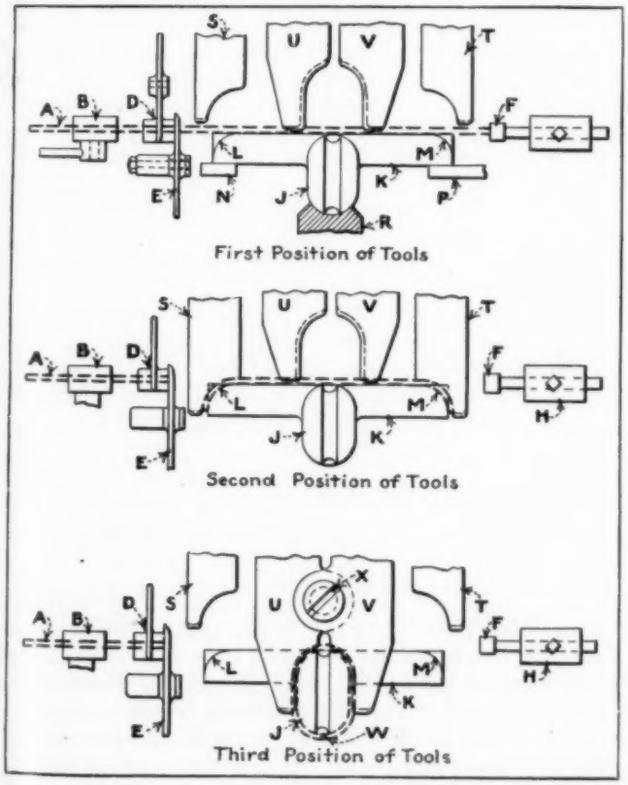


Fig. 6—Tool positions for forming a simple flat chain link. The action requires movements from the four sides, from the bottom, and a revolving motion of the gripping slides on one side

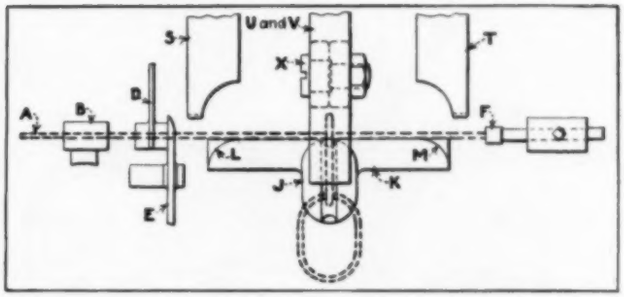


Fig. 7—Final position of the chain tools shown in Fig. 6. This position shows the gripping slide revolved a quarter turn to receive the wire for the next link

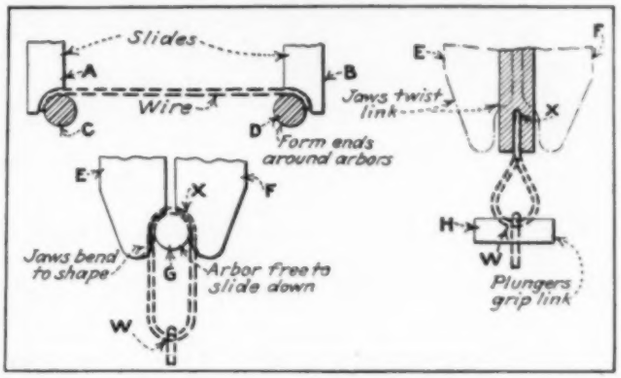


Fig. 8—Slide actions for forming a twisted wire chain link. In addition to the slide actions from five directions, a revolving motion of one set of slides is required

around the arbor into the position shown at the third position of the tools, the ends previously bent going around the front end of the arbor, thereby completing the link. It will be noticed that the jaws U and V pivot on a stub X, and as these jaws start in to form the link, they are opened slightly and are afterwards caused to close in and pinch the link tightly on the arbor. The joint on the chain link is welded, soldered, or left open, as the case may be, the welding where required being done in place by vertical slides.

After making one link, the arbor J drops down, leaving the link suspended in the jaws U and V. These jaws then travel backwards part of the length of the link and revolve a quarter turn, placing the chain link at right angles to its former position, thereby presenting the open ring shape of the chain link to the wire entering for the next link. This is shown in Fig. 7. The procedure for making the second link is a duplicate of the first, the jaws U and V revolving back to their original position and taking the first advance position on the wire, as shown in the "first position of tools" in Fig. 6. The formed links are pushed down through the slot in J

Another illustration of chain forming on the same class of wire-forming machine is illustrated in Fig. 8. The general operation of the machine is similar to that which has just been described, except that instead of one combination arbor being used to form the links, three separate arbors are used, while a method of twisting the links to make a twisted jack chain is also employed. The form is fed into position and cut off in the usual manner, after which the slides A and B form in around the arbors C and D, which are shown in sections. Jaws E and F now move into position and form the chain links around the arbor G at the center. A plunger coming up from below in the machine, and an-

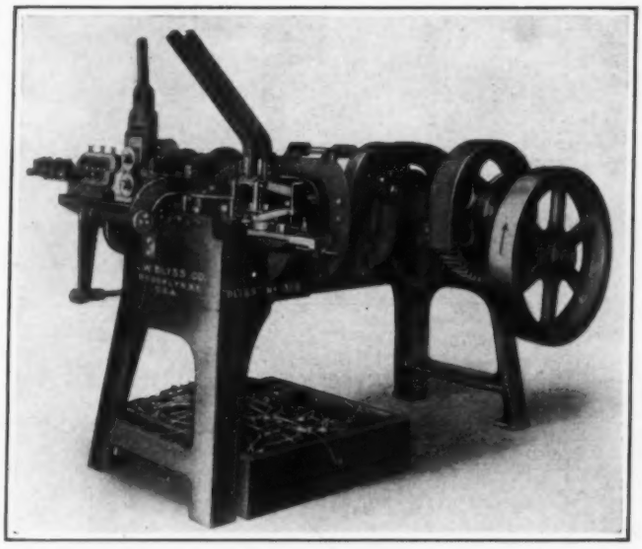


Fig. 9—A wire-forming machine with magazine feed for the attached part

other plunger going down from the top, both indicated as *H* in the lower view of the illustration, now grip the outer end *W* of the chain link and hold it securely, while the arbor *G* travels down clear of the link, leaving the end *X* gripped in the jaws, as shown in the middle view. The jaws now revolve a quarter turn, twisting the link to the shape shown, and then revolving in the opposite direction, so that there will be no kinks in the chain as it is made.

It is not intended here to show more than the diagrammatic nature of the tools, in order to illustrate the principles of operation. It can be seen that the general principles are the same, and that by changing the cam arrangement, the slides, and the tools, an infinite variety of wire articles can be formed. Wire-forming machines of the same type can also be made to enable the assembling of incidental parts onto the wire articles. This usually must be done before the final bends on the wire are made. An example of this is the forming of wire pail handles, where a wooden handle must be assembled in the center of the wire. This is done by locating a magazine to drop the wooden part into position, so that the wire is fed through the hole of the handle, following which the ends of the wire are looped and the bends made in the regular way. A machine for this purpose is shown in Fig. 9. An important feature of all wire-forming machines is that they must be constructed in such substantial fashion that they will stand up and deliver a high volume of production day after day.

Reducing Spoilage by Proper Instruction—*Discussion*

By John B. Sladen

THE subject of the editorial in the *American Machinist*, on page 632, Vol. 69, entitled, Reducing Spoilage by Proper Instruction, is one that is being, and has been, discussed by industrial executives. It has been demonstrated that there is little question as to the need for more and better instruction in most shops. Instruction is a necessity in the reduction of the waste due from unnecessary spoilage. The man who is largely responsible for the instruction of the worker is the foreman.

The foreman is the natural instructor—to very many workers he is the only instructor. Many workmen have had little schooling, and much of what they had did not stick. The foreman can make a good workman out of a bad one. He can create a love for a good, honest job. To do this effectively, he must continue the instruction work that was done by the old foremen in the days of general apprentices, and supplement it with modern ideas.

The necessity for the instruction of the workman has increased because the work has become so highly specialized. In the past, the worker had a much better chance to get some education out of his work, and to learn the proper method of doing work, than has the worker of today, because he used all the tools in the place and made all the parts of an entire job. Yet he would not have been able to take full charge of completing the job without the wise instruction of the foreman and his patient educational influences, born of his pride in his craft, his trade, his job, and the accomplishment of good work.

The reason why spoilage occurs usually lies in the fact that the worker is not properly instructed. There are many shop executives who think that instruction consists in ordering others. But that is not instruction. Unfortunately, many plant executives do not see the necessity for instruction. They think that orders are all the instructions that any worker needs.

The progressive executive knows better. He is sufficiently close to the workers to know how much can be accomplished by teaching them how to keep the machines in good order, how to manage their work, how to rest themselves with a maximum effect and in a minimum time. He knows that many of the workers have been "pitchforked" into their particular jobs in industry, without any real preparation; and he knows how little they understand about the machines they operate and the work they do.

The good foreman knows these things, and he is in a fine position to give the men a better understanding of the machines they operate, of the tools they work with, and of the work they are doing.

Part of the job of being a foreman is to instruct the man, not merely on the orders for the day, or the job; not merely on the rules, but on the reason for these things. The foreman is largely responsible for the good workman in the group under him, and, to the same extent, for the poor workman. Instruction is necessary, however, if the poor workman is to advance, and this instruction will not only benefit the entire group, but also will increase the output, and will aid in the reduction of spoiled work.

It is pointed out by Dr. H. C. Dickinson, Chief of the Heat and Power Division of the Bureau of Standards, that the best available data on civilian flying showed that less than 20 per cent of the accidents are due to engine or power plant failures. The failure of the human element is responsible for the great majority of casualties. All who are interested in the building of machinery will be glad to note the reliability that has been attained in this field where heavy and long continued duty is demanded, and, evidently, received.

The Design of Hobs for Taper-Threaded Joints

By EARLE BUCKINGHAM

Associate Professor of Engineering Standards and Measurements
Massachusetts Institute of Technology

Analysis of the thread includes side cutting and height of fillet at both ends of the hob. Influence of rake on hob teeth

HAVING determined all of the necessary values for the thread on the pin in the first part of the article, we will determine the corresponding values for the thread in the box before attempting to analyze the results. The co-ordinates of the profiles here will be identical to those on the pin. As a matter of fact, it is not necessary to determine these co-ordinates when both members are hobbed except to satisfy our own curiosity as to the exact form, as under these conditions they will always be identical. Also, as noted before, these values are the most difficult to determine accurately as the departure from a straight line is usually so very slight. In this case, this departure would be measured in millionths of an inch.

Therefore, for the thread in the box, we have to determine only the side-cutting and the height of the fillet. Starting with the longer lead at the large end of the box, we have the following values for the determination of the amount of side-cutting at the middle of the thread:

$R = 1.112$ in.
$r = 2.263$ in.
$C = 1.151$ in.
$a = 0.20624$ in.

Whence from equation (8) we obtain

$t = 0.00476$ in.

We will now determine the height of the fillet at the root of the thread from equation (9). For this we have the foregoing values and

$d = 2.323$ in.
$H = 1.172$ in.

Whence $f = 0.00942$ in.

For the shorter lead at the large end of the box we have the following values for the determination of the amount of side-cutting at the middle of the thread:

$R = 1.112$ in.
$r = 2.263$ in.
$C = 1.151$ in.
$a = 0.20403$ in.

Whence from equation (8) we obtain

$t = 0.00466$ in.

We will now determine the height of the fillet at the root of the thread from equation (9). For this we have the foregoing values and

$d = 2.323$ in.
$H = 1.172$ in.

Whence $f = 0.00922$ in.

The conclusion of the article.

We will now determine the side-cutting and fillet conditions at the small end of the box. For the side-cutting at the middle of the thread with the longer lead we have the following values:

$R = 0.921$ in.
$r = 2.072$ in.
$C = 1.151$ in.
$a = 0.20624$ in.

Whence from equation (8) we obtain

$t = 0.00431$ in.

We will now determine the height of the fillet at the root of the thread from equation (9). For this we have the foregoing values and

$d = 2.132$ in.
$H = 0.981$ in.

Whence $f = 0.00859$ in.

For the shorter lead at the small end of the box we have the following values for the determination of the amount of side-cutting at the middle of the thread:

$R = 0.921$ in.
$r = 2.072$ in.
$C = 1.151$ in.
$a = 0.20403$ in.

Whence from equation (8) we obtain

$t = 0.00422$ in.

For the height of the fillet at the root of the thread we have the foregoing values and

$d = 2.132$ in.
$H = 0.981$ in.

Whence from equation (9) we obtain

$f = 0.00840$ in.

We will now summarize the values we have obtained.

Tangent to thread profile at middle of thread at large end
of thread on pin and box, longer lead 75 deg. 33 min. 28 sec.
of thread on pin and box, shorter lead 75 deg. 33 min. 23 sec.

Side-cutting at middle of thread at large end
of thread on pin, longer lead 0.00203 in.
of thread in box, longer lead 0.00476 in.
of thread on pin, shorter lead 0.00199 in.
of thread in box, shorter lead 0.00466 in.

Height of fillet at root of thread at large end
of thread on pin, longer lead 0.00417 in.
of thread in box, longer lead 0.00942 in.
of thread on pin, shorter lead 0.00498 in.
of thread in box, shorter lead 0.00922 in.

Tangent to thread profile at middle of thread at small end
of thread on pin and box, longer lead
75 deg. 34 min. 8 sec.
of thread on pin and box, shorter lead
75 deg. 34 min. 3 sec.

Side-cutting at middle of thread at small end	
of thread on pin, longer lead	0.00248 in.
of thread in box, longer lead	0.00431 in.
of thread on pin, shorter lead	0.00243 in.
of thread in box, shorter lead	0.00422 in.
Height of fillet at root of thread at small end	
of thread on pin, longer lead	0.00508 in.
of thread in box, longer lead	0.00859 in.
of thread on pin, shorter lead	0.00498 in.
of thread in box, shorter lead	0.00840 in.

From this tabulation we see that the amount of side-cutting at the small end of the pin is about 0.00045 in. more on each side than it is at the large end, while the side-cutting at the large end of the box is about the same amount more on each side than it is at the small end. These variations thus run in opposite directions, but as the thread of one member fits into the space of its mating member, the resulting conditions of fit are almost mathematically perfect, the difference being apparent only in the fifth decimal place. Thus the thread form on the hob for the pin should be made about 0.0050 in. thinner than the theoretical thread to allow for the side-cutting, while that on the hob for the box should be made about 0.0080 in. thinner.

As regards the fillets at the roots of the threads, the crests of the threads should be chamfered or rounded to clear these fillets. These calculated fillets are based on conditions that would exist with sharp corners on the hobs. Thus if a fillet is made on the corner of the hob tooth, the crests of the mating threads should have fillets larger than those on the hob by an amount about equal to the calculated height of the fillet. For example, if a fillet of about 0.015 in. radius is made on the crests of the threads on the pin and in the box, the fillets on the hob for the pin should not be larger than 0.010 in. while those on the hob for the box should not be larger than 0.006 inch.

The differences between the angles of the teeth on the hob and the threads on the work are so small that no definite correction need be made on the hob, except that this difference may be considered in the light of a tolerance. That is, the angle of the side of the tooth of the hob should not be less than 14½ deg., and it may be 3 or 4 min. greater.

Influence of Rake on Hob Teeth

The foregoing discussion is based on the use of hobs with straight, radial-cutting flutes. If a positive rake, or hook, is introduced on the cutting flutes, it will distort the form of the cutting edges because of the relief on the hob teeth. The amount of this distortion will depend upon the amount of relief and the amount of rake.

The surfaces of the teeth of a hob of this type, with annular teeth, without relief, are conical in form. When relief is introduced, this relief in effect changes these conical surfaces to helicoidal or screw surfaces, the lead on opposite sides being in opposite directions. Thus when

R = radius of cutter (or hob) profile, in.
h = distance off center of hook flute, in.
A = cutting angle of hob teeth
A'' = angle of relieved surface and relieving tool
D = angle of relief
F = angle of hook
N = number of cutting flutes
E = radial relief per flute, in.

Then
$$\tan D = \frac{NE}{2\pi R} \qquad (10)$$
$$h = R \sin F \qquad (11)$$
$$\tan A'' = \frac{\tan A}{1 - \tan D \tan F} \qquad (12)$$

The resulting profile of the cutting edge will be slightly curved, but this curvature will usually be less than that on the profile of the hobbed thread and its nature is such that it reduces the curvature on the hobbed thread. Here again, one variation tends to compensate for another if nature is left to take its own course.

As a definite example, we will determine the amount of the angular distortion at the large and small ends of the hobs used to produce the pin and box shown in Fig. 1. We will assume that the hob for the pin has 24 flutes with a radial relief of 0.040 in. per flute, and has a rake angle, or hook, of about 7 deg. This hook would be obtained by grinding the cutting flutes a constant amount off center, so that its angle will be slightly different at the large and small ends of a taper hob. Thus for the large end of the hob for the pin we have the following values:

$R = 1.806$ in.
$A = 14$ deg. 30 min.
$N = 24$
$E = 0.040$ in.

From equation (11), using the approximate value of 7 deg. for the angle of the hook we obtain

$h = 0.220$ in.

From equation (10) we obtain

$\tan D = 0.08460.$

Transposing equation (11) to solve for sin F, we have

$\sin F = h/R = 0.12182$
$F = 6$ deg. 59 min. 49 sec.
$\tan F = 0.12273$

Then from equation (12) we have

$\tan A'' = 0.26133$

whence $A'' = 14$ deg. 38 min. 44 sec.

For the small end of the hob for the pin we have the following values:

$R = 1.615$ in.
$A = 14$ deg. 30 min.
$N = 24$
$E = 0.040$ in.
$h = 0.220$ in.

From equation (10) we obtain $\tan D = 0.09461$.

Transposing equation (11) to solve for F, we have

$\sin F = 0.13622$ $F = 7$ deg. 49 min. 46 sec.
$\tan F = 0.13751$

Then from equation (12) we obtain

$\tan A'' = 0.26203$

whence $A'' = 14$ deg. 40 min. 59 sec.

As the relieving tool must be made of constant form, there will be a difference of 2 min. 15 sec. between the resulting cutting angles of the hob at the large and small ends, this angle being largest at the small end of the hob which in this case cuts the large end of the pin.

We will now determine the conditions of the smaller

hob for the box. For the large end of this hob we have the following values: We will assume 16 cutting flutes with the same relief per flute as before.

$$R = 1.112 \text{ in.}$$
$$N = 16$$
$$E = 0.040 \text{ in.}$$

And from equation (11)

$$h = 0.135 \text{ in.}$$

From equation (10) we obtain

$$\tan D = 0.09160$$

Transposing equation (11) to solve for F we obtain

$$\sin F = 0.12140 \qquad F = 6 \text{ deg. } 58 \text{ min. } 23 \text{ sec.}$$
$$\tan F = 0.12231$$

Then from equation (12) we obtain

$$\tan A'' = 0.26155$$

whence $A'' = 14$ deg. 39 min. 26 sec.

For the small end of the hob for the box we have the following values:

$$R = 0.921 \text{ in.}$$
$$N = 16$$
$$E = 0.040 \text{ in.}$$
$$h = 0.135 \text{ in.}$$

From equation (12) we obtain

$$\tan D = 0.11060$$

Transposing equation (11) to solve for F we obtain

$$\sin F = 0.14658 \qquad F = 8 \text{ deg. } 25 \text{ min. } 44 \text{ sec.}$$
$$\tan F = 0.14818$$

Then from equation (12) we obtain

$$\tan A'' = 0.26293$$

whence $A'' = 14$-deg. 43 min. 52 sec.

On this hob there is a difference of 4 min. 26 sec. between the cutting angles of the hob at the large and small ends, this angle being largest at the small end of the hob as before. In this case, however, the small end of the hob cuts the small end of the thread in the box. Therefore if we wish to keep this variation to a minimum, the angles on the hobs should be corrected so that the resulting threads would match at about the middle of the taper. At the same time, as a correction is necessary because of the hook flutes, we can also introduce at the same time an angular correction for the side-cutting. This last correction would be about plus 4 min. for both hobs.

Thus the angle for the relieving tool or grinding wheel for the hob for the pin should be about 14 deg. 44 min., while that for the hob for the box should be about 14 deg. 45 min. 30 sec. The resulting thread forms would then match almost exactly at the middle of the taper and would have a difference of about 3 min. in angle at each end. This error, in the depth of thread of 0.120 in., would amount to a profile error of about 0.00011 in., which is smaller than the probable errors of execution in the production of the hobs and work.

High-Strength Welds in Copper

ALTHOUGH the best grades of commercial copper plate and sheet contain only 0.01 to 0.08 per cent oxygen, investigations by the Union Carbide and Carbon Research Laboratories, Inc., have shown that this is sufficient to affect the weldability of the metal. The heat of welding causes the cuprous oxide present in the copper to separate out at the grain boundaries of the base metal along zones parallel to the weld and a fraction of an inch away from it. This separation of oxide at the grain boundaries produces zones of weakness in the base metal. Even though the weld metal may be perfectly sound, these points of lower strength still exist in the base metal and thus reduce the efficiency of the joint.

Since oxide causes the trouble, copper entirely free from oxide should give better results. Tests made with copper plate completely deoxidized with silicon and welding rod of similar composition proved this to be the case. The strength of the welds approaches that of the base metal and can be further increased by hammering and heat-treating. Consequently for best results in welding copper, specify metal completely deoxidized with silicon and use deoxidized copper welding rod.

Reducing the Cost of Upkeep on Shaving Dies

By Frank C. Hudson

SHAVING dies present a problem that is somewhat different from other phases of die work. Shaving being a finishing operation, it is necessary to keep the dies very close to size, and permissible wear is reduced to very small figures. The dies must be kept sharp or they cannot leave smooth edges on the pieces to be shaved. As the cost of sharpening some dies is rather high and adds appreciably to the cost of production, anything that lengthens the life between sharpenings is of real value.

One of the methods of reducing the upkeep of shaving dies is to stop the piece in the die, and push it out with the next piece. The stroke of the press is adjusted so as to leave the piece half way through the die. The next piece forces the first piece through the die and leaves the second piece in its place. The results obtained by this method bear out the statement that it is good practice.

Another method came through the development of the "chatter" press, credit for which evidently belongs to the National Cash Register Company, the press having been developed in its plant. The theory is that of cutting by a series of blows with a sharp chisel and a light hammer, rather than with a heavy hammer at one blow.

The shaving operation with the chatter press is a series of short movements, varying from 0.020 to 0.002 in. with a slight recession between strokes. Just why this action is easier on the cutting edges of dies, is not easy to understand. For any reversal of motion in a lathe tool or similar cutting edge has a tendency to injure the edge. The results obtained by the use of the chatter press, however, prove its worth in prolonging the life of dies between grindings. In one instance, in the plant of the Monroe Calculating Machine Company, the life has been increased from 30,000 to 80,000 pieces between grinds. And as the cost of grinding the dies averaged $80, the saving is well worth careful consideration.

The intermittent movement of the ram is secured by a cam having a series of concave surfaces. The roll drops into the hollow before being forced further by the next rise, which is a little higher than the preceding one. The cam is laid out to give a decreasing movement at each rise as the pieces are forced through the die. The last movement is but 0.002 in. The work comes out of the die very clean and smooth. The intermittent cam and the roll make a chattering noise, hence the name of the press.

· THE · FOREMAN'S · ROUND · TABLE ·

The following narrative is a "case" presentation of the topic. It has been written to involve some of the questions that arise in the average shop. For guidance in preparing discussion the questions at the foot of the page have been prepared

Getting Ideas from Other Shops

"I SEE Jack Shimer, of the grinding department, is back on the job—been away on a vacation, I guess," said Ed, as he and his fellow foreman climbed into a homeward bound bus after the day's work.

"No, Jack has been on a little inspection trip," answered Al. "Williams sent him out to get some new ideas from some of the automobile shops in Detroit."

"And did he get anything? Doesn't seem like the kind of a chap who would see much unless it was pointed out to him."

"You can't always tell about a man that way," replied Al. "Looks are very deceptive. One of the best doctors I know isn't at all good to look at. But Jack did pick up some good ideas.

"You remember how the man on the honing machine complained of sore hands from having so much kerosene on them all day? Jack found a shop that mixes about ten per cent of machine oil with the kerosene, and it seems to stop the trouble. Found several other things, too, so Williams told me this morning."

"Such as?"

"One thing was a method of putting the responsibility of doing a good job up to the man himself. In this case it was a welder, but it can be worked in many other cases. And I like the idea."

"Seems to me that would take a lot of bookkeeping, and I've got plenty of tickets to make out now."

"No paper work. Just a brass ticket in the shape of a small plate with the man's initials and the date of the weld. After he's made an important weld, such as a break in the frame of a big machine, he tacks this little identification tag on the frame near the weld so anyone can see who did it."

"Kind of hard on the man if it's a poor weld, isn't it?"

"That's what it's meant to be. No good man does a poor job intentionally. He may make a mistake or use poor judgment, but if it's his fault, a fair man is ready to take the blame. This notion can be used in other work, too. It puts a feeling of responsibility on the man and makes him more careful. Williams is figuring out different ways to use the same idea."

"But I doubt if such things are worth the cost of the trip, counting time off and all," grumbled Ed, getting ready to leave the bus at the next corner.

Is Al right that it pays to get ideas of this kind from other shops? Or is Ed's doubt justified. As a test, could either of these ideas be applied in your shop?

All foremen are urged to discuss these questions vital to their work; of course the

discussion is not limited to foremen. Letters accepted and published will be paid for

Discussion of Earlier Topics

Equipment and the Foreman's Reputation

THESE days, it costs so much more to sell goods than to make them, that managers may be inclined sometimes to consider machine tools as minor matters. The best thing the dissatisfied foreman can do is go to his boss and say, "If you will buy such-and-such a machine for my department at a cost of $1,000, I will agree to make it earn $500 the first year." If the boss thinks he can make more money by using the thousand to buy advertising, he won't get the machine for that department, or any other.

Just for the present we fellows who try to cut costs in the shop are at a decided disadvantage. One of the better makes of cars is reputed to cost something like $200 for direct labor when it rolls out of the shop, but the bunch of fellows who sell it rake off $1,200. If this is true, then what's the use trying to cut 69 cents off of the shop cost? —ENTROPY.

The Boss's Son in the Shop

WE SUFFERED from a bad case of the boss's son in one plant where I worked for many years. He came on as an apprentice when his father was just a foreman. His father became shop "super," and the son filled his father's shoes as foreman.

As the boss's son he was privileged to make tools from the company's stock, and on its time. He had every conceivable tool that one could need, from all lengths of face-plate bolts to accurately-ground sine bars and angle plates. He was privileged to play jokes and get away with it. He owned an automobile, and repaired it at the company's expense, with their stuff. We were thankful that the boss had only one son. —CHAS. H. WILEY.

Holding Back on Piece Work

IN OUR shop we know that piecework men often fail to turn in all the work they have done in a given day. The reasons for this are several. In the first place, the men are only allowed to turn in, say, $1 an hour and the maximum for an 8-hour day is $8.25. Naturally enough these men wouldn't turn in a piecework card for $10, although their day's work may have entitled them to that much. They won't turn it in because they know that the limit allowed is $8.25. Then, too, they figure that by turning in so much money, the boss will think the rates are too high, and will cut the prices on their various jobs.

Because we know that there are many conditions that can help or hinder the pieceworkers it is not best to make it against the rules for workmen to carry over money from a good day to bolster up his card for a poor day. —J. J. THOMPSON.

THE · NEXT · TOPIC

How About a Christmas Party?

ADVANCE QUESTION

Williams wants to pull off a Christmas party for the men and their families to promote good fellowship. Al tells Ed how one shop did it. Ed points out objections. What about it?

Should the Men Support Their Own Club?

BY ALL MEANS, the men should support their club, and for the following reasons: First, the opportunity to contribute a little each month brings to the men more clearly what the company has done for them in erecting the club house. Second, a feeling of teamwork between employer and employee is created. Third, a feeling of ownership is instilled, whereby each man takes it upon himself to keep the clubhouse clean and orderly. Fourth, it brings about an atmosphere of good sportmanship, one of the most important principles around which the clubhouse idea was conceived.

—W. C. STEGNER.

Letting Good Men Get Away

THERE is nothing more detrimental to good work than flagging interest on the part of the worker. Interest can quickly be stimulated if the worker is made to understand that opportunity for advancement exists, and that promotion is practiced.

The job ahead does not necessarily have to be vacant at that time. Vacancies occur unexpectedly, and giving the worker encouragement by letting him know that he is likely to be promoted, because of his good work, to a higher position when that position is open, will give the worker a brighter outlook and will stimulate his interest in the work he is now doing. —LOUIS SCHAFFER.

THIS is merely another problem in handling men. As a rule, it is not possible to promise advancement to a man in the shop because he may become self-important and impatient, and may take advantage of the foreman. If there is a man who will make a good foreman, he is worth a little more than the regular man in wages, and some suitable method should be found for informing him as to his prospects. —F. F. HERMAN, *Foreman.*

· BOOK · REVIEWS ·

INDUSTRIAL ORGANIZATION AND MANAGEMENT. By William B. Cornell, professor of management, and chairman of the Department of Management, School of Commerce, Accounts and Finance, New York University. Six hundred fifty-three pages, 5¾x 8½ in.; one hundred thirty-two illustrations. Published by the Ronald Press Company, New York, N. Y. Price $5.

BROAD in scope, and covering a very large number of items, this book is suitable for those who wish to find in one volume a rather complete statement of recent management developments, together with fundamental principles of management. Following a foundation of five chapters on management trends and principles, and executive control, comes an analysis of the product, the plant, equipment, labor, and supervision; the activities and relationship of the major departments; production control, time studies, the foreman, wage payment plans, and budgets.

The irreducible minimum of organization functions is listed as general management, accounting and office procedure, engineering, purchasing, selling, and manufacturing. These major divisions are broken down into the necessary subdivisions, and each treated in some detail.

A.S.S.T. HANDBOOK, 1929 EDITION. Five hundred and eighty-two pages, 4¼x7 in. Published by the American Society for Steel Treating, Cleveland, Ohio.

THE A.S.S.T. Handbook has been published in loose-leaf form for almost five years, and is being issued for the first time in bound form. The principal divisions are as follows: General data, heat-treatment, carburizing, steels and alloying elements, cast iron, pyrometry, metallography, testing, furnaces, heat application, refractories, forging, and non-ferrous metals. It is proposed to have the handbook issued annually in bound form, and to distribute it to all members in good standing, free upon receipt of the previous copy, or at a cost of $5. Members of the Institute of Metals Division of the A.I.M. & M.E., who are not affiliated with the A.S.S.T., may purchase this edition of the handbook for $5, and other non-members of the A.S.S.T. for $7.50.

THE NEW WAY TO NET PROFITS. By Fred W. Shibley, vice-president, Bankers Trust Company, New York. Two hundred and six pages, 5½x8 in. Indexed. Published by Harper & Brothers, New York, N. Y. Price $3.

THIS latest book on the science of business is a practical treatise dealing with the making of net profits in business and industry. The theme is predicated upon the fact that in the light of present-day competition, manufacturing output must be controlled by the amount of output that can be sold by any one company. The first step indicated is market study, then the adoption of a merchandising policy based upon quality, design, style, color, preparation and service. Both preliminaries lead up to the major question of distribution, which is studied in some detail. The practical application of these analyses is exemplified in the preparation of the sales forecast, which is made clear by the use of an actual example. The production planning necessary to conform with the sales forecast is then discussed.

As a necessary corollary to planned sales and production comes budgetary control of expense, and Mr. Shibley takes considerable pains to emphasize the growing importance of this modern tool of management. Other chapters treat of the broad principles of management, from the board of directors down, and of the importance of research and analysis. In conclusion, the author states that lasting prosperity is based upon unrestricted flow of information as between consumers and producers throughout the entire stream of distribution.

The book is thus designed to give a broad picture of a business system that is bound to produce profitable results if followed. It illustrates by examples drawn from many fields the practical application of the system, and is therefore convincing, besides being thoroughly readable.

ENGINEERING DRAWING. By Harvey H. Jordan and Randolph P. Hoelscher. Four hundred four pages, 6x9 in., cloth-board cover. Published by John Wiley & Sons, Inc., 440 Fourth Ave., New York, N. Y. Price $3.

ELEMENTARY theories underlying drawing practice, and illustrations explaining the theories and demonstrating methods of execution, are the basic contents of the volume, the subject matter being treated from a point of view of student and teachers, and those who require a knowledge of drafting. The text is divided in two parts, having as separate sections an appendix and a chapter of problems.

Part I deals with the four fundamental forms of projections and their application in mechanical and free-hand drawing, including lettering, the use and care of instruments, shop terms and processes, pictorial drawing, perspectives, sketching and reproduction of engineering drawings. Part II treats the application of these principles to various fields, such as architectural, structural, map and patent-office drafting.

The appendix contains symbols and conventions used in miscellaneous branches of drafting, geometrical constructions, and tables of data usually needed in the drawing room. The chapter of problems has ten sections covering orthographic projection, fasteners, shop drawings, and isometric, oblique and perspective projections. Illustrations are used extensively throughout the volume to treat the principles and theories covered. The information will be found useful to engineers and others desirous of perfecting themselves in the technique of drafting, the graphic language.

THE RELATION OF EDUCATION AND INCOME. This 31-page, 6x9-in. booklet is the result of a study made by Alpha Kappa Psi Fraternity for the year 1926-27 on the earning power of graduates of various classes of higher schools and colleges as related to the earnings of the average man from the elementary grade schools. The results are based on the returns from 7,396 individual reports, and although not conclusive, are sufficient to indicate the enormous advantage which the educated man has in the business world. The booklet is well arranged and is illustrated with a number of effective charts showing the comparisons at different ages. It is published by the Alpha Kappa Psi Fraternity, Inc., 1050 North Delaware St., Indianapolis, Ind. Copies are obtainable at 50 cents each, or 20 cents in lots of a hundred.

Inspection Methods *and Their Application*

By Fred H. Colvin
Editor, American Machinist

Gages and fixtures for the rapid and accurate inspection of such parts as valve mechanisms, timing chains, fork-shifter shafts and steering knuckles

THE design and construction of the Stutz valve gear involves inspection methods that are not found in other types of engines. This engine has an overhead camshaft, which, together with all the valve mechanism, is assembled with the cylinder head. The valves are actuated by the cams bearing directly on top of hardened cylindrical nuts, which lock the valves and valve pistons, or guides, on the threaded stems in the proper position to give the desired clearance between the cams and the nuts. One of these nuts is shown in Fig. 163 being tested for hardness on a Brinell machine.

The valve springs are tested for compression on the device shown in Fig. 164. It has been built up over a Toledo scale, and contains an indicator, so that the amount the spring is compressed at a given weight is easily read by the inspector.

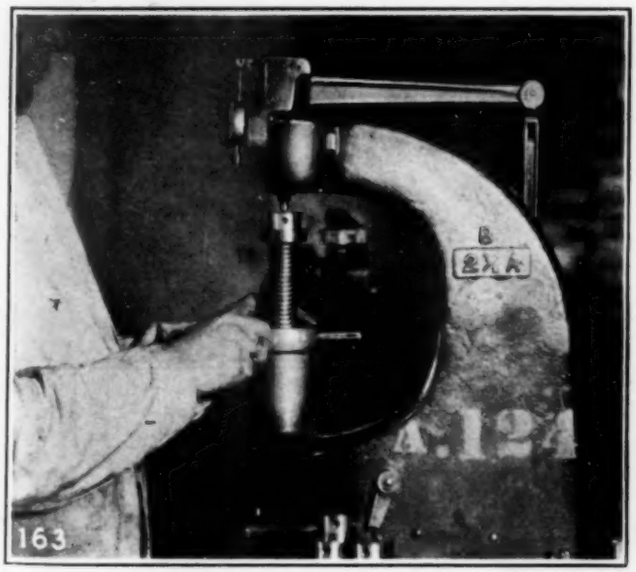
The lower end of the valve stem is guided in a standard-type bushing, such as is shown being tested in Fig. 165. The bushing is mounted on a mandrel and revolves under the pointer of the indicating gage shown. This inspection is for diameter and concentricity.

The valve pistons, or guides, are being inspected in Fig. 166. These parts are held to very close tolerances, as the ability to resist tipping or cocking of the valves depends on their fit. Great care is taken to keep them a close working fit in the upper valve guide, which is bolted to the top of the cylinder head. This construction can be seen by examining Fig. 167, where the camshaft and the valves are in place.

Some of the detailed inspections are shown in the figures that follow. Fig. 168 shows the under side of the head, the valve openings, compression chambers and other points being inspected in this position. The valve tools are shown behind the cylinder head. In Fig. 169 the seats for the upper valve guides are being checked for diameter, as the proper fit of the guides is very important. In Fig. 170, the upper guides are in place, and both their diameter and their alignment with the lower guides is being checked by the gage shown. In Fig. 171 the upper guides and the valves are assembled, and the end holes are being checked.

Testing the timing chain is done on the device shown in Fig. 172. The fixture is simply an angle plate on which are mounted two fixed studs and one moveable stud. The studs are arranged for carrying sprockets so that chains of various lengths can be tested. The

The first part of the eleventh article. The concluding part will appear in an early issue.



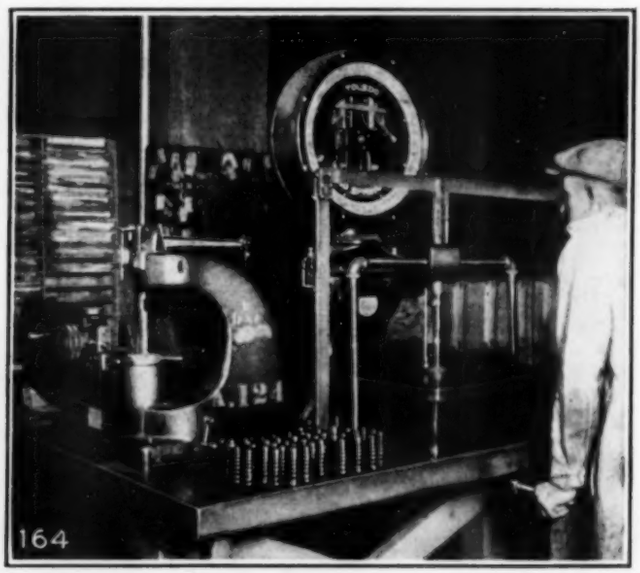


Fig. 163—Brinell-testing hardened nuts for top of valve stems. These nuts receive the wear of the cams and their hardness is important. The testing machine is set at a convenient height for the inspector. Fig. 164—Checking stiffness and compression of valve springs. A special device has been built over the scale so that the compression can be easily read for any given load. The Brinell tester and the timing chain device are also shown

Fig. 166—Checking valve-stem pistons for diameter and roundness. The pistons guide the upper ends of the valve stems and prevent the valves from tipping or cocking under the action of the cams. The pistons are tested 100 per cent to insure proper valve action

Fig. 165 — Checking diameter and concentricity of valve-stem guide. The guide is mounted on a mandrel and revolves between centers. The multiplying-lever indicator enables close measurement to be taken. Concentricity is important in the functioning of the valves

Fig. 167—Camshaft and valves assembled on cylinder head. This view shows the guides for the pistons and how the valve-stem nuts take the thrust of the cams. It also shows the compactness of the whole valve-operating mechanism

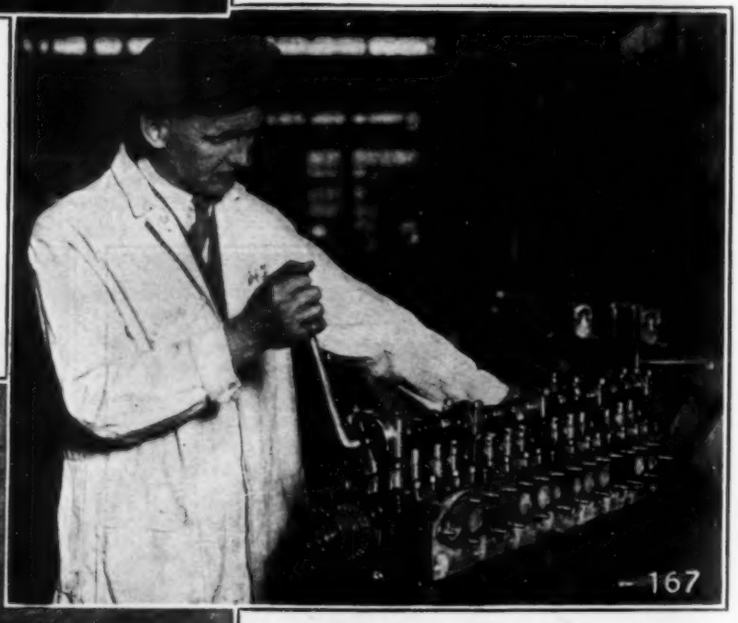


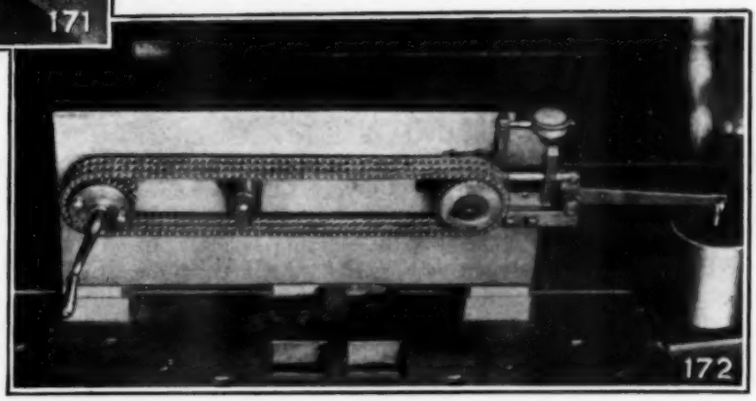
Fig. 168 — Inspecting underside of cylinder head. Valve-hole diameters, combustion-chamber depths, and other points are checked while in this position. This engine has dual ignition, the spark plugs being located on each side of the head

Fig. 169—Inspecting the counterbored seats for the upper valve-stem guides. The guides are shown assembled in Fig. 170. Counterboring separate surfaces requires great care to prevent spring in the tool while in action

Fig. 170 — Checking concentricity of the lower valve-stem guides and the upper, or piston, guides after assembly on the cylinder head. These points are important, as freedom of valve movement, together with a full bearing is necessary for the best results

Fig. 171—Cylinder head with upper guides in place and valves assembled, ready for the camshaft. The end hole for the stud for the chain sprocket is being inspected for diameter In Fig. 167 the sprocket is shown in place

Fig. 172—Fixture for testing the stretch of timing chain. One sprocket is mounted on the fixed stud at the left and the other is mounted on a stud connected by a bell crank to the weight at the right. A given load is imposed on the chain, the stretch being shown by the dial indicator. The fixed stud near the center is for testing a shorter chain



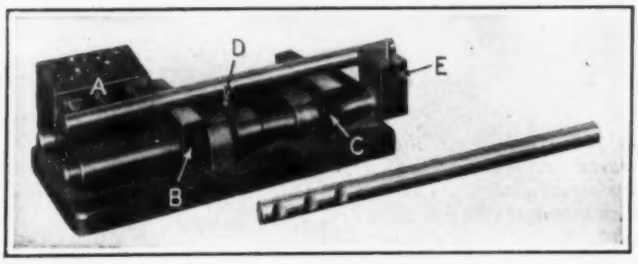


Fig. 173—Fixture for checking the position of the cross-slots in the Franklin shifter shaft. The construction of the fixture is very simple, the two bars carrying the supports and the gages. There are three cross-slots at one end and one at the opposite end

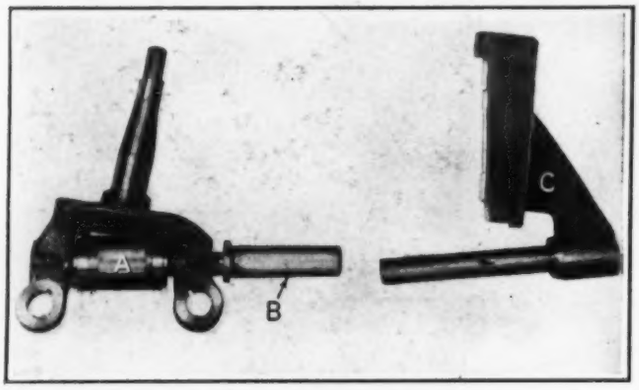


Fig. 174—Checking a steering knuckle. The plug and cylinder gages at the left show clearance, the cylinder gage representing the end of the axle. The gage at the right checks the angle of the hole with the axle, the contour gage showing how the different portions line up with the hole

stud at the right is movable and its position is controlled by the bell crank and weight shown at the end. Any desired load can be put on the chain, which is then turned by hand, using the crank shown at the left. The action of the chain is noted on the dial indicator at the upper right-hand corner. This fixture not only shows the action of the chain, but also stretches it to some extent, and the amount of stretch can be determined by the dial indicator.

Several inspections at the Franklin plant follow: The first being the use of a simple fixture for checking the various grooves and indentations on the fork-shifter shaft, and is shown in Fig. 173. The three grooves at the end are placed against the three projections at *A*, the shaft being supported in the blocks *B* and *C*. The spring-plunger hole is checked by the plug *D*, while at *E* is a pin operated plunger, the other end of which fits into the groove at the right-hand end of the shaft. While the tolerances are not particularly close, it is necessary for the various notches to be correctly spaced within reasonable limits, and this fixture is a very simple one for the work.

The gages used in inspecting the steering knuckles of the Franklin car are shown in Fig. 174. At the left, the gage *A* is held in position by the plug *B* which slips through both bearings on the yoke end of the steering knuckle. The flanges on *A* must clear the inside of the yoke, the amount of clearance being determined by a feeler gage. The gage *C*, which is shown at the right, checks the angularity of the axle portion with the holes through the ears of the yoke, and also the contour of the various parts of the axle. The diameter of the various portions are, of course, checked by other gages.

Drawing Room Illumination

By Jim Henderson

When asked as to what he considers the best method of artificial lighting for the drawing room, the average draftsman will reply that he prefers the individual light placed a short distance above the board, the direct rays to be shielded from the eyes by means of a suitable shade. Where it is necessary to use the light for only a short time toward the close of the day, no serious eye-strain may result, as the injurious effect is only temporary.

However, should the draftsman be called upon to work at night, working several consecutive hours under artificial lighting conditions, he will eventually become cognizant of the additional eye-strain. This may be partly accounted for by the increased period of time spent at the drawing board, but the eye-strain in particular is largely due to the unsuitable lighting.

While, in some respects, the individual unit may increase the illumination to a desired confined area, it is this localized brilliancy that is the primary cause of excessive eye-strain. With the eyes fixed on the drawing, the irises are adjusted for a certain strength of light, and when reference is made to a text book, other data or objects—out of the direct rays of the lamp—the irises are forced to readjust themselves (often quite suddenly) to the darker surroundings of the general office. This may happen many times in the course of an hour, necessitating the expansion and contraction of the irises at each successive change of light.

Many years ago, I adopted the practice of always momentarily closing the eyes when turning on or off the electric light. This minimizes the sudden reaction of the nerves of the eyes and relieves them from the almost instantaneous change necessary when they are kept open while switching on or off the electric light, or glancing suddenly from a highly illuminated surface, or room to the opposite extreme, or vice versa.

Another objectionable feature of the low, individual light is that its position is generally such as to cause the reflected light from the glossy surface of the tracing cloth to indirectly strike the eyes.

One of the arguments advanced in favor of the close light is the necessity of seeing the lines of the drawing. In answer to this, it might be well to suggest the use of a slightly softer pencil that would produce a more distinct line, particularly on work that must be done at night.

For general office lighting, a well-diffused light is most suitable, one where the distribution is practically uniform, and of approximately one candlepower to each square foot of floor space when the ceilings are of average height.

While direct lighting from above is not wholly objectionable, the indirect lighting by means of reflectors is very much to be preferred, together with a ceiling and walls that will assist proper diffusion of the light. Converts of this method of lighting are not over enthusiastic at first, but in a short time they admit it is much better.

Analysis of Principles Involved in Task Work with Bonus

By Walter N. Polakov
Consulting Engineer

BECAUSE of the lack of connection between the conclusion of this article and the first installment, published last week, it may help to review the introduction. It read as follows:

The following analysis undertakes to trace the logical coherence of some managerial principles following necessarily from a given set of postulates. No attempt is here made to outline the technique of their application, chiefly because it cannot be alike in any two individual cases, and partly because the technique in each individual case would reveal itself to an experienced person from the principles outlined and circumstances encountered.

III

Task

An ideal industrial community may be described in the words of Kipling:

"They shall work for an age at a sitting and never be tired at all."

Prison treadmill is the most repulsive form of work because of the lack of objective.

A clearly defined objective or a goal provides natural interest in its approach for attainment.

Task is a goal or an aim set for attainment.

A goal has a lure, otherwise it is a blur.

An indefinite task signifies the incompetency of management, which *wants* more and better work, but does not know *how much* and *how* to do it.

Authority to set a task involves the obligation to provide means for performing it.

Task may be defined in terms of *Quantity* or *Quality* of work or both.

Elimination of all avoidable wastes and losses in production is an ideal task for Industry.

Elimination of wastes and losses presupposes:

a—*Skill* in correct operation,
b—*Will* to exercise the skill (i.e., to operate correctly).

Acquisition of skill and stimulation of will are twin functions in striving for perfection.

It is the function of management to provide means for acquisition of skill through instructions and training. (II)

It is likewise the function of management to provide incentive for exercise of will in striving for perfection, through:

a—arousing interest in the work
b—gaging progress in achievements
c—presenting graphic score of results.

A hobo in a play says: "If you make my work fascinating, perhaps I will work." . . .

An intellectual worker applying for a position writes: "If you assign to me a task, I will find interest in it. Yes, in any work."

A professor formulates this general propensity:

"To feel the lure of perfection, . . . is to be human; not to feel it is to be subhuman." (Cassius J. Keyser.)

Very few people, if any, are subhuman.

Work that fascinates a worker lures him toward perfection.

Some dread repetitive monotony and seek fascination in the exercise of mind and novelty of situations.

Many prefer familiar manipulations and seek fascination in watching stock of finished work grow.

The problem before a management engineer is to find means to make work fascinating for each kind, thus releasing the desire (will) to do the best work.

It is not the work itself which is distasteful, but the circumstances under which it is done.

The removal of irritating or deadening conditions is the first step in *arousing interest* in the work.

To *gage progress* in acquiring and exercising skill it is necessary to have the goal and a measuring stick.

A clearly defined task with circumstances and method specified presents a goal.

Comparison of what was done with what should have been done (task) is the measuring stick.

Measurements of quantity of output (production) and inspection of quality of work must be as far as possible:

1—continuous
2—immediate
3—impersonal (automatic, fair)
4—obvious (visible, understandable)

Uncertainty in measurements or inspection is more deadly than uncertainty of a task. Where there is no confidence there is no co-operation.

Results attained by each should be made known to all.

Baseball players do not hide their scores, they take pride in them.

Visual presentation of progress in the performance of a task has the advantages of:

1—Emotional appeal
2—Intellectual clarity

A man-record chart pictures the fact in logical space; it is a model of reality.

The extent of accomplishment (output, efficiency) is shown by the length of a line in the space representing the extent of the task for each man, every day, is a picture of his attainment.

Such a record is the history of his own improvement compared with that of others.

Failures due to no fault of a man are marked by causes beyond his control.

This compels management to investigate and remove the obstacles.

Setting task is a job of an investigator-engineer. Forming the habit of industry is a job of instructor. Comparing performance with task is the job of a clerk. Removing the obstacles is the job of a foreman. Co-ordinating all functions is the job of an executive. Efficiency of task workers reflects efficiency of management.

IV

Reward

Suitable personnel, available knowledge and interest in work assure contribution "from each according to his ability."

Reward commensurate with accomplishment means: "to each according to his service."

Reward for good luck—is gambling.
Reward for another man's service—is usury.

Therefore, a bonus without a definite task accompanied by necessary instructions and training is mere gambling, not sound management.

Likewise, premiums and profit-sharing plans are schemes to get something for nothing, as the reward is the result of external circumstances, not of personal effort or skill.

Bonus is a reward for skill exercised with a predetermined degree of perfection.

Bonus is therefore a reward for those who learn.

Bonus is not a "payment for result," for if method was correct, but conditions beyond the control of a bonus worker spoiled the result, bonus is paid.

No bonus can be computed without task being established and working conditions fully specified.

Every trained person by following the instructions shall be able to perform task and earn bonus every day.

In other words: a task is set not for exceptionally strong or exceptionally capable ones. The fulfillment of the task and earning of the bonus follow the fulfillment of the prescribed method and specified conditions.

A task must be liberal enough to enable a trained worker to exceed it by a fair margin to safeguard against discouragement and allow for some fluctuations of external circumstances.

A task must be severe enough to call for the exercise of special skill and command undivided attention to safeguard against slipshod operation and wandering of the mind.

The amount of a bonus must be liberal enough to make its earning desirable.

Amount of bonus is determined within these natural limits:

Minimum—when it fails to be attractive

Maximum—when it is equal to or larger than the economy resulting from the fulfillment of the task.

Economy resulting from quantity-task work with bonus is due to increased production within the same period of time. It appears therefore in the following accounts:

a—reduced prorata of general overhead and administrative expense
b—reduced machine expense per unit (rent, depreciation, insurance, interest, etc.).
c—reduced inventory of goods in process of manufacturing (interest on liquidated capital).

Economy resulting from quality-task work with bonus appears under the following heading: (independently or in addition to those listed in preceding paragraph)

a—savings in material and supplies used
b—reduced expense of inspection
c—increased market-value of the product.

Attainment of the task and earning bonus must be made known:

1—immediately (before return to work)
2—to all concerned.

Such procedure gives encouragement in case of success for next day's work, or gives warning before the same faults are repeated; gives opportunity to improve upon own work before the cause of lost bonus is forgotten; gives chance to compare scores with those of other members of the team or shop; offers opportunity to check up any error in bonus calculations before data are filed away; assures open and above-board attitude of management; simplifies accounting.

Any failure to live up to the task and thus to earn bonus must be likewise made known before the worker returns next day to work by informing as to:

3—cause of lost bonus

or:

4—reason for allowing bonus on task missed.

Bonus is equally applicable to time-rate and piece-rate.

Bonus is equally applicable to quantity production and quality of the process.

Original piece-rate or day-rate in all cases is retained and paid as a base-wage for all performances below task.

Performance equal to or exceeding the task requirements is rewarded in addition by bonus payment.

Bonus may be permanent (fixed) for any performance equal to or exceeding the task.

Or, bonus may be sliding, increasing as higher degrees of excellence are attained.

Fixed bonus is indicated where conditions beyond the bonus-worker's control are the determining factors of quality or quantity (e.g., efficiency of steam generation).

Sliding bonus is indicated where exceptional personal latitude is present beyond the control of management (e.g., supervision, sales organization, etc.).

Payment of bonus should be with each pay-check.

Bonus should not be changed unless the method of doing the task is changed.

Task is not changed unless machinery, material, or method is changed.

Cost of installing task work with bonus is an *investment,* not an operating expense.

Industrial organization built on the principles specified in the preceding paragraphs makes provision for:

1—proper fitting men to jobs and jobs to men.

This feature reduces costly turn-over of labor, develops esprit de corps, accumulates high skill and earns good will.

2—offers opportunities to learn better ways of doing things.

This feature produces expert personnel, improves workmanship, reduces spoilage, creates pride in the trade, leads to new improvements and further economies, promotes safety, and minimizes favoritism.

3—Standardizes production.

By means of definite task for all or most jobs, production can be scheduled, output increased, shop cost reduced, overhead distributed. It thus provides greater satisfaction among employees, minimizes irritating conditions, removes old obstacles, pushes production faster through the shops.

4—Standardizes costs.

By means of definite task with bonus for its attainment, the cost per unit of product tends toward the lower level, supervision simplified, cost easily allocated, estimates become more dependable, earning increases without added labor cost to the product.

Metric Propaganda in England
Discussion

By E. Andrews
Manchester, England

THE editorial on page 332, Vol. 69 of the *American Machinist,* is of more than passing interest because, in spite of the strong demand by the advocates for the introduction of the metric system in the United States and Great Britain, all attempts to effect the change by legislation have failed. The fact that scientific men find it useful, is no argument that the metric system would be equally advantageous to machinists and engineers in the workshop. Two-thirds of the trade of the world is carried on by the United States and the British Empire in the British system of units of length.

The statement that Great Britain is losing world trade through not using the metric system, is not new. Similar statements have been made for a quarter of a century. There is no evidence that trade left Great Britain to go to some country where the metric system was used. Contracts that specify metric units are taken by both American and English shops. It is more a question of ability than utility, and both countries have the ability.

It may be interesting to mention that some few years ago the staff of the various departments of one great railroad system in Great Britain was asked by the general manager to make a report on the metric system. The result was that in no case was it favored. On the other hand, it was pointed out that the initial cost of making the change would be very large. An example of this was the cost which would be involved in changing the marked tare of the 3,000,000 freight cars in use, which it was estimated would cost over a dollar a car; and that was only one item.

SEEN · AND · HEARD

By John R. Godfrey

Grinding—Armored planes—Wabble plate engines

ABRASIVES continue to play a larger part in machining as the years go by. From heavy cutting that removes metal so rapidly as to become a rival of milling, to the production of extremely well finished and accurate surfaces, we are making constant advances. The so-called honing process has been developed far beyond our early anticipation. By selecting the proper grade of abrasive stone, or block, to suit the work, we can produce a mirror finish inside a long tube or other hole that also has the merit of accuracy. New applications of this process are being tried in a number of fields and we are likely to see the method grow as the years go by or until something else takes its place.

* * * *

Taking time by the forelock is instanced by the building of an armored plane to carry currency and securities. Two machine guns and bullet protection, similar to that provided in armored cars, are part of the program. The armored plane can also be used by police in chasing bandits. More metal construction, more uses for machinery, but what a commentary on a so-called peaceful civilization!

* * * *

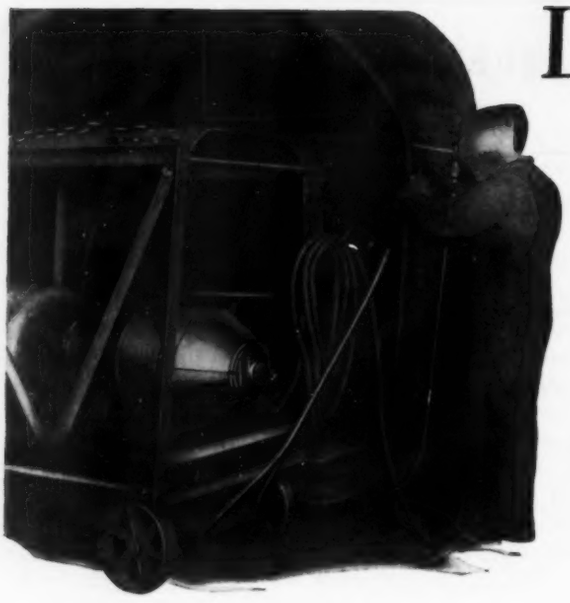
Some types of machinery and devices seem to go in cycles. Piston valves for locomotives began to be used away back in the 1830's in Scotland. Then they went out of fashion and slide valves held sway for many years. But every now and then some designer would slip in a piston valve and they gradually came into use once more, until it is now hard to find a slide valve except on locomotives built many years ago.

Another design that has had its cycles is the type of engine known as the "wabble plate" drive. Instead of having a crankshaft, as is usual in engine design, the work of the pistons is transferred to a plate set at an angle. And as one piston after the other gives its push against this wabble plate, the plate revolves and transmits the power through a central shaft.

My own recollection of this goes back to the Colt Disk Engine in the 1880's—a steam engine. Since then I have seen good friends sink scads of money in modifications of this type of engine, with internal combustion cylinders in these later days. Out in Seattle some years ago I ran across another sample that afterward went to Dayton, where the army aviation corps played with it for airplanes—at no small cost. Now another comes from Australia, and, strangely enough, it seems to be working out very well as a pump or compressor.

Will it work out commercially? Who knows—and who today dares to say a thing "can't be done"? For the next thing we know some one does it.

Welders should be required to make sample welds periodically and have them tested either by pulling in a tensile testing machine or by bending them in a vise. The latter test is easy to make and has been used for years to test welders' ability.



Locomotive Parts Repaired by Welding

An outline of the welding equipment used by a Mid-Western shop, and various examples of the work handled

ELECTRIC welding, at the Topeka, Kan., shops of the Atchison, Topeka & Sante Fe Railway System, is used quite extensively in connection with locomotive repairs.

The main building, which houses the blacksmith, boiler, machine, and erecting shops, is 1,200 ft. in length. Some form of welding is done at practically every section, therefore, two distinct methods of handling the work have been adopted. One is to have a central welding department located at the east end of the shop, to which miscellaneous small parts are routed. The other is by portable welding units, which handle the larger class of work.

In the central welding department is a four-panel electric welding unit, on a balcony at one side of the room. It supplies welding current for the outfits in three booths, and for a portable outfit. The booths are partitioned off by either canvas walls or a wire-woven asbestos material, and are provided with suitable doors, so that the glare from the arc will not affect other workmen. An overhead crane is provided to aid in the handling of materials.

Welding at other parts of the building is handled by several portable welding units. These outfits are distributed at various points, each of which handles a stipulated class of work. The locations of the units and the work handled are as follows:

1. Southwest—Driving boxes and wheels
2. Central west—Spring rigging and engine repairs
3. Central east—Stokers and boosters
4. North end—Tanks and cab work, and sheet-metal repairs
5. North end—Miscellaneous sheet-iron work
6. Southeast—Connecting rods and motion work.

In most cases these units are set up at definite locations and have portable booths located alongside. In this way, the work is transported to the booth for welding and then returned to the machines for finishing. One of these units is illustrated in Fig. 1, the booth showing in the background.

When it is necessary to transport a portable welding unit, it is pulled, if the distance is short, or moved by an overhead crane, if the distance is long. Current at 220 v. is distributed throughout the shop, with convenient outlets, so that a unit can be used at any desired location.

Practically all welding is handled by eleven men. Six of this number are in charge of the portable units, and the balance operate the stations of the central welding department. All welding is under the supervision of a gang foreman whose duty it is to route the work and to see that it is done properly.

Steel containing over 0.25 per cent carbon is not welded, because tests have shown that the welding heat affects the structure of the steel. Welding is largely confined to the building up of worn surfaces and no attempt is made to weld defects, excepting in such parts as wheels and frames.

In filling-in worn connecting rods, the practice is to weld bronze to the worn faces. Rods repaired in this manner hold up exceptionally well, since the bronze surface comes in contact with a steel one. The welding of flues to fine sheets enables better steam-tight joints to be made. The welding of manhole frames in tenders is a good example of the saving in labor by welding. When

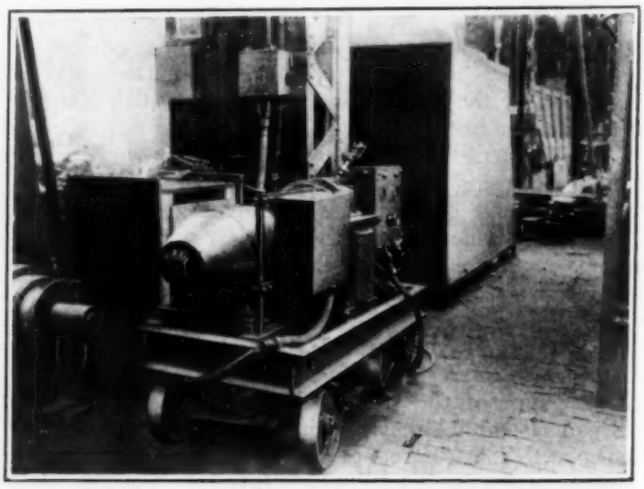


Fig. 1—Several portable welding units are distributed at various points within the shop, each of which has a portable booth erected close by. By doing the welding at several points, transportation of work has been reduced considerably. The welding units are seldom moved, but when they are, the shifting is done by overhead crane if the haul is long, otherwise the unit is pulled by hand

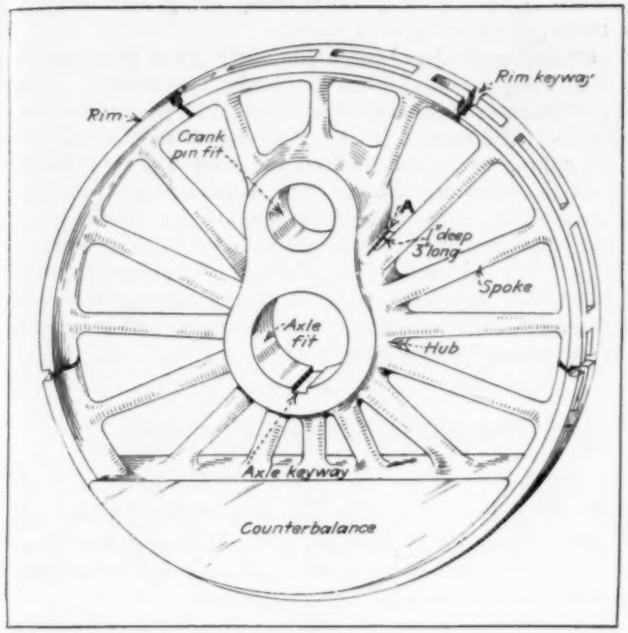


Fig. 2—Repairs needed on major locomotive parts are recorded on a form which shows the nature of the repair, the engine number, the date, and any remarks that may be required. On the form is a sketch of the part, such as the one above, with a reference mark showing the location of the repairs necessary. The sketch is of a driving-wheel center that requires a hub repair

the work was done by riveting, three men were required to handle the job, whereas by the present method, one man can do the job alone. Among some of the other jobs handled are the assembling of jaws to tender truck-frames, the building up of brake beams, and the filling-in of worn spots in driving boxes and crossheads.

In making repairs to the major parts of locomotives, a form giving a report of the worn or broken part is used. An outline of the part is shown on the form, such as is shown in Fig. 2 for a defective driving-wheel center, so that reference to the exact places to be welded can be made. On the form is listed the name of the part, the engine number, the date, the kind of material and a statement of the work required. The places to be repaired are shown in red. For example, in the driving-wheel center shown, a section of the hub, 1-in. deep and 3 in. in length, as shown at *A*, is to be welded.

Reports of this type enable a close record to be made of all welded parts, so that if they fail in service, a check can be made, showing when the job was done and what was the nature of the original defect.

The welding equipment is also used in connection with shop maintenance. Very often some type of repair comes through that can be handled advantageously by this method. For example, in fitting pipe lines throughout the shop, the sections are welded together instead of being joined by couplings.

In addition to electric welding, there are various uses for acetylene welding. Portable acetylene outfits are available, in order that work at various parts of the plant can be handled. In repairing worn conveyor screws, the present practice is to build up the worn surface by depositing a sufficient amount of metal on the edge of the threads to restore the screw to its original diameter. For this work, the fixture in Fig. 3 has been devised. The work is located on centers, being driven by an air

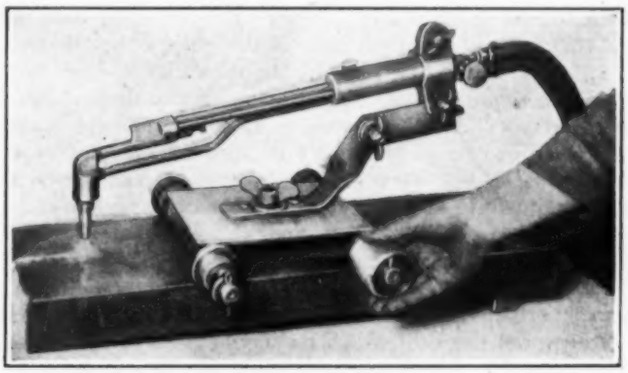


Fig. 4—With this acetylene cutting device, different kinds of straight cutting operations are performed. As shown, it is cutting a channel in two, longitudinally. The torch is attached to a roller plate that rides on the work. The advantage of the unit is that the cut is made straight and that the torch is held at a proper distance from the work after it has been once set properly

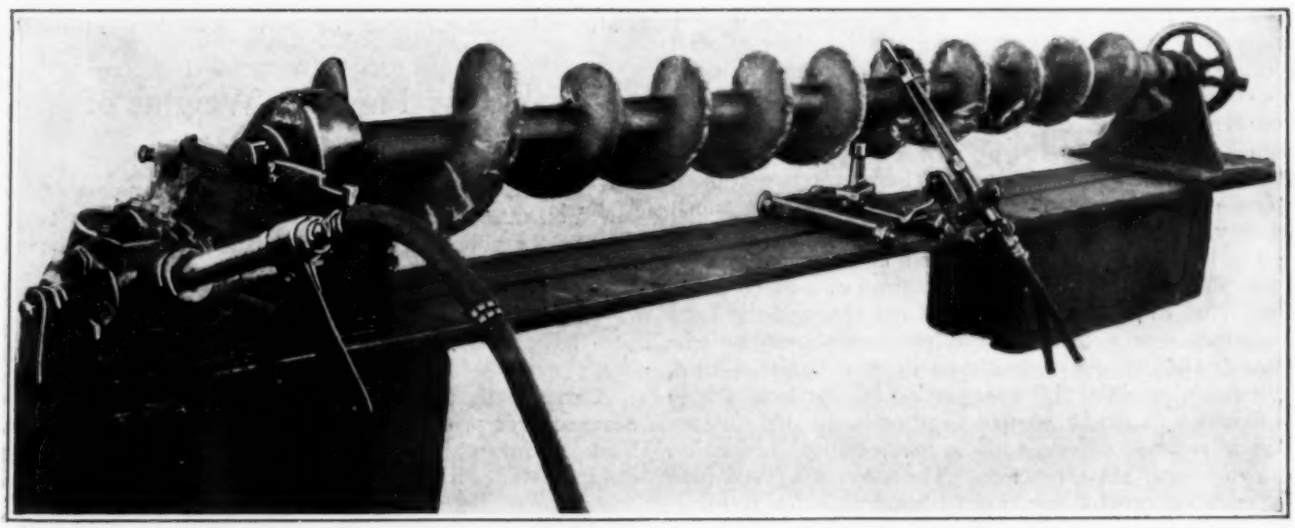


Fig. 3—Worn conveyor screws are built up by welding to the original diameter. The screw is located on centers and is driven by an air-operated motor and reduction gearing. On the table of the fixture is a plate mounted on rollers, to which the welding torch is attached. A projecting member at the center of the plate carries a roller that strikes the advancing surface of the screw. As the work is revolved, the torch plate is moved

motor operating through reduction gearing. On the table of the fixture is a plate mounted on rollers, to which the welding torch is attached. A projecting member at the center of the plate carries a roller that strikes the advancing surface of the screw. With the roller in place rotation of the screw causes the plate to move horizontally in relation to the pitch. Hence, with the welding torch in place, the only duty required of the operator is to feed the welding rod at the point of contact.

Another welding fixture is shown in Fig. 4, this one being used when cutting steel channels. The torch is attached to a plate mounted on rollers and is moved by hand.

The headpiece shows a portable electric welding unit being used in making a cab repair. The operator wears heavy asbestos gloves to avoid burning his hands, and a sheet-metal head guard equipped with colored glass as an eye protection.

Apprentice Training

By P. C. Cornish

MOST concerns have been handicapped by inability to secure good men. They are frequently able to get the quantity required, but not the quality they desire.

It is not always the fault of the man that he does not meet the requirements. Many have simply drifted into machine work, and, being able to make a livelihood, have continued in it with practically no training or ability for the work. Some have served an apprenticeship which consisted mainly of four years employment with one concern, with sort of a "sink or swim" policy that if a boy survives four years, he is a mechanic. This policy is certainly an injustice to the boy, who has invested four years, perhaps in something unsuited to him, or who has not acquired the skill which he should have in this time. The natural or even necessary thing for him to do is to go outside for "experience"; whereupon the manufacturer asks all to gaze upon the ingratitude of former apprentices, and says that apprentice training doesn't pay. Of course it does not pay either the company or the boy under these conditions.

Some progressive companies have established apprentice courses under expert supervision and are giving the apprentice excellent training. These companies do not always reap the benefits they should from their efforts, because they too often become "happy hunting grounds" for employment managers from neighboring concerns, or even from outside cities. The number of these companies is too few to supply the entire industry with skilled workmen nor should the burden rest on them when others benefit by the training almost as much as they.

The logical solution seems to be a co-ordinated or uniform plan among all the manufacturers of a given locality. This can usually be worked out through the local manufacturers' association. A director should be employed who has had experience in work of this kind. Wherever possible, the co-operation of the local school authorities should be secured to provide suitable instruction in related subjects such as mathematics, mechanics, drawing, and shop practice. The success of the plan depends on careful selection of applicants for training, and also on the ability of the instructors provided. Where the size of the plant does not warrant the full time employment of an instructor, he can divide his time between several, co-operating with the foreman in order that the boys may be given training along lines helpful in their particular type of work.

Some progress has been made along these lines and is giving good results when properly supervised. The Manufacturers' Association of York, Pa., in conjunction with the City School Board, established such a plan in 1911, taking as its model a course started several years before in Fitchburg, Mass. The manufacturers of Milwaukee, Wis., are successfully operating a similar plan employing nearly 1,000 boys in over 100 industrial plants. The Newark, N. J., College of Engineering has applied this co-operative plan to engineering training, and many of the graduates are now employed in executive positions in Newark plants.

Simple Rules for Foremen

By W. S. Davenport

CERTAIN matters have led us to formulate the following set of instructions to our foremen, which we feel may also be of interest to other small or medium sized shops. The rules are as follows:

1. The foreman should examine the work being done by each one of the men in his charge, to make sure that each operation is done according to the blueprint and is correct in every way, and that all operations for his department are completed.

2. He should have jobs always laid out in advance for his workmen, so that when the jobs on which they are working are completed, others will be ready.

3. He should get the tools ready for the next job to be given to a workman, and in the case of machine operators he should set up the tools in the machine ready for the workman to run.

4. He should see that each man is working efficiently and comfortably, so that a man can produce the maximum amount of good quality work, and that all conditions are such as will make the work agreeable to the workmen, so that they will remain with us.

5. He should see that each employee is ready for work at the starting signal, and should remain working until the stopping signal.

6. If the foreman has but few men, he can do some of the regular machining or other work, but his first duty is always to take care of all of the work above mentioned.

Table for Figuring Weights of Press Stock—*Erratum*

ON THE reference book sheet published on page 663, Vol. 69, of the *American Machinist*, the last two lines of the note at the bottom of the sheet should have read:

Using previous example: 234 lb.
$\times$ 1.077 = 352 lb. brass required.

A mammoth steel casting, which is stated to be the heaviest ever produced, has recently been made in England. It forms the anvil block for a 5-ton friction drop stamp. Made of comparatively soft, plain carbon steel, the original casting weighed 140 tons. The weight after machining is 95 tons. The dimensions are: Height, 6 ft.; block base, 9 ft. 2 in. by 10 ft. 2 in. Machined holes of an average depth of 2 ft. 6 in. pierce the sides of the block, and vary from 5 to 7½ in. in diameter.

Heat-Resistant Alloys

(Continued from Sheet No. 38)

Calite

Calite is the trade name of an iron-nickel alloy of the class known as heat-resistant alloys. It is made in various grades, and resists oxidation when subjected to continuous heating up to 2,000 deg. F. A typical Calite contains 35 per cent of nickel, 5 of chromium, 50 of iron, and 10 of aluminum. It has a melting point of 2,775 deg. F. Its tensile strength is 56,800 lb. per sq. in., and the specific gravity is 7.03. Calite is cast easily, and is used chiefly for boxes for heat-treating purposes. It cannot be machined, nor cut with the gas flame. It is a product of the Calorizing Company, Pittsburgh.

Chromel

Chromel is the trade name of a nickel-chromium alloy used for heat-resistant castings, and for electrical resistance wires and thermocouples. It is a product of the Hoskins Manufacturing Company, Detroit, Mich. Chromel *A* contains 80 per cent of nickel, and 20 per cent of chromium. Chromel *P* contains 90 per cent of nickel, and 10 of chromium. Chromel *C* has 64 per cent of nickel, 11 of chromium, and 25 of iron. The tensile strength of Grade *A* is about 120,000 lb. per sq.in., and the melting point is 1,420 deg. C. The melting point of Grade *C* is 1,390 deg. C., and that of Grade *P* is 1,435 deg. Centigrade.

Fahralloy

Fahralloy is the trade name of a heat-resistant and corrosion-resistant alloy used for making annealing and carbonizing boxes, and for chemical machinery parts. It is made in thirteen grades, containing different percentages of chromium and nickel, and will withstand continuous temperatures up to 2,200 deg. F. without oxidation. Some grades can be machined, and are ductile and malleable, while others are hard and brittle. It is a product of the Southern Manganese Steel Company, St. Louis, Missouri.

Hybnickel

Hybnickel is the trade name of a group of heat-resistant alloys made by Victor Hybinette, The Pusey and Jones Corporation, Wilmington, Del. Alloy *A* withstands temperatures up to 2,100 deg. F., and is used for carburizing boxes, hearth plates, and furnace conveyor parts. Grade *B* is a "high-rigidity" alloy for temperatures up to 1,800 deg. F. Other grades are *C*, *D*, *R*, and *S*. The latter two are especially made for acid resistance.

Q-Alloys

Q-Alloys is the trade name of a series of nickel-chromium alloys manufactured by the General Alloys Company, of Chicago. A typical composition is 68 per cent nickel, 20 per cent chromium, and small quantities of silicon, aluminum, and iron. They are of the class of heat-resistant alloys, and a tensile strength of 27,000 lb. per sq.in. is claimed at a temperature of 1,750 deg. F. The alloys are usually cast into boxes for high-temperature work, but the metal is also furnished in sheet form, and in bars, and can be fabricated by welding. Q-alloys will withstand temperatures up to 2,200 deg. F. without scaling. They can be cast into intricate shapes. The color is silvery gray.

Rezistal

Rezistal is a chromium-nickel-silicon "steel" manufactured in several grades, all of which have high percentages of nickel and chromium. It is non-magnetic, and is resistant to heat, chemical action, and corrosion. Its specific gravity is 7.76. It casts very well, making sharp, clear-cut castings. It is rolled and forged at a yellow heat, about 2,000 deg. F. When annealed for several hours at 1,750 deg. F., and cooled in a furnace, it can be machined readily. It can be forged and welded. In drawn-wire form its tensile strength is as high as 150,000 lb. per sq.in. The average tensile strength of the rolled metal is 100,000 lb. per sq.in., with elongation of 20 to 35 per cent and Brinell hardness of 225 to 300. All grades of Rezistal are highly resistant to oxidation and scaling up to 2,200 deg. F. At 1,760 deg. F. the tensile strength is said to be 21,000 lb. per sq.in. It is therefore valuable for use in baffle plates, spark plug electrodes, and other uses where heat resistance or acid resistance is required. It is highly resistant to sea water or mine waters. Rezistal is manufactured under U. S. patents 1,420,707 and 1,420,708 by the Crucible Steel Company of America, New York City.

Silcrome

Silcrome is the trade name of a heat-resistant alloy steel used for automobile-engine valves. It contains high percentages of silicon and chromium, and has a medium carbon content, It is claimed to withstand temperatures up to 1,700 deg. F. for long periods without scaling. For internal combustion engine valve use it does not burn, pit, or warp. It machines readily. Silcrome is a product of the Ludlum Steel Company, Watervliet, New York.

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· TECHNICAL · ABSTRACTS ·

Foreign Branch Plants

When we speak of establishing a branch production plant abroad, we must satisfy ourselves that in all essential respects the country where the plant is contemplated presents a situation parallel to that which we find at home. In other words, we must be certain that there is a fairly good domestic demand; that the taste of the consumer has been developed, or is susceptible for development to a high level; that the sources of raw materials are near enough to make it unnecessary to buy the material abroad or that they may be imported at reasonable tariff rates; that the labor situation is free from complications, and that help is available at reasonable rates; that the labor element has an aptitude for modern methods of production; that transportation facilities are both plentiful and flexible for reaching inland points; that there are no laws or official regulations which in any way hamper or incapacitate the plants for functioning within fairly independent limits; that the various foreign tariffs on goods imported from that country are not prohibitive or can at least be offset through the other items in the cost of production and distribution.

It is also important to determine what interference or co-operation may be expected from the trade associations, and that the national taxes and other imposts, as well as local taxes, are not too burdensome. Another element to be considered is to what extent the company should be "naturalized" in the country.

The determinant of a profitable operation of a production plant anywhere is the inland consumption of the particular commodity. The countries best suited for locating branch production plants would be those highly industrialized and already active in foreign trade.—Arthur J. Grey, *Printers' Ink Monthly*, November.

Obtaining a Satisfactory Zinc Coating

By the time zinc reaches the coating stage, it contains other metals besides those listed as standard. Prime Western slab zinc, the standard zinc used for galvanizing, should contain not over 1.60 per cent of lead and 0.08 per cent of iron. Other metals are sometimes put into the zinc purposely, while others find their way into the metal during regular daily operation. Metals found in hot zinc in galvanizing baths are lead, iron, cadmium, aluminum, tin, and occasionally antimony.

Experiments conducted when galvanizing with pure zinc showed that very good spangles could be produced without the addition of aluminum or other metals to the bath. It was found after a few days of operation, and when no metallic additions had been made to the bath, that the surface of the hot metal would quickly oxidize. For this reason pure zinc would be impractical to use even when not considering price.

Lead is not harmful in zinc for two reasons. First, it alloys with the zinc only in very small amounts, and second, any excess lead settles to the bottom of the pot.

Most of the practical galvanizers' troubles come from iron in the zinc, although at present most of the slab zinc on the market meets the requirements of the standard set. It is good business policy to check up on all slab zinc when it is received. Iron in zinc has a tendency to give the metal a brass-yellow color and to give its grain a fine, sandy appearance. Pure metal has a bluish lustre and large bright crystals.

Cadmium tends to produce very fine, small spangles, which are not attractive, and antimony will cause the coating to be brittle and to have a yellow discoloration. Aluminum is desirable when the bath is open, for it tends to give the coating a bright appearance, while keeping down the excess oxidation of the zinc. Tin also has been used for some time to develop large spangles on sheets.—Wallace G. Imhoff, *Iron Age*, October 4.

Budgeting for Changes

Budgeting for changes is the important work that the General Motors Research Corporation does for the parent company. It is the business of this organization to discover, analyze, and recommend improvements in products and methods according to the economic laws of change.

Trouble results if a manufacturer decides upon definite, long-term program of sales and production and fails to budget for changes. Suppose he charges off 6 per cent of his valuation per year in his costs for depreciation and 5 per cent for interest. Next suppose that after a term of years, during which his machines have paid for themselves, he enters a period of close competition and tries to benefit from obsolete machines costing him nothing. His competitors will devise newer and faster methods, and then his troubles will begin. Then if the manufacturer, depending upon permanent static stability, has failed to put into his prices large sums of money for complete revamping, he is done.

Rapid economic changes are relatively new. Whether or not any proposed mechanism should be installed in a factory must be decided in accordance with economic laws. If the new mechanism is a special machine which can never be used for anything but one purpose, it should pay for itself in a year. The greater the cost of the special machine, the sooner it should pay for itself, or otherwise it should be done without. Current practice is now to avoid gigantic, costly special machines. It is preferable to get the same results by a combination of mechanisms which can be redistributed to other jobs without loss at any time.—Charles F. Kettering, *The Magazine of Business*, October.

Deterioration of the Cyanide Bath

A quick, efficient, and economical way of obtaining a hard, superficial wearing surface is by the process of cyaniding, or casehardening. Low-carbon steel treated in this manner absorbs carbon and nitrogen from the molten mass, and these two elements develop mineral hardness in the newly formed layer when the metal is quenched in oil or water.

The immersion method is the one most commonly employed. Sodium cyanide is used in varying degrees of concentration. A 98 per cent sodium cyanide bath is very effective as a carburizing medium. The same is true of a standard mixture containing 76 per cent sodium cyanide and the balance sodium chloride. Other mixtures have been placed on the market containing sodium cyanide, sodium chloride, and sodium carbonate. The chloride and carbonate do not contribute to the carburizing action, but their presence raises the melting point of the compound, thus hastening the reaction.

A newly prepared bath of 43 per cent sodium cyanide gave maximum penetration. After several days' operation, however, it showed an appreciable decrease in depth of case, notwithstanding the fact that the solution had received fresh additions of material. This deterioration continued from day to day. Chemical analyses indicated that cyanide decomposed when subjected to heat. It was found that the rate of deterioration is not constant nor uniform. Scale and rust adhering to the inside of the pot aided the decomposition of the bath. On the other hand, a thoroughly cleaned receptacle showed a lesser degree of dissociation.

The sodium cyanide on exposure to air and heat is gradually oxidized to sodium cyanate, and this is formed rapidly when sodium cyanide is heated in contact with iron and iron oxide. The exhaustion of the bath was not compensated for by the addition of a salt of moderate sodium cyanide content. A 43 per cent cyanide bath should be replenished with 76 per cent or 98 per cent sodium cyanide. Routine chemical analyses are necessary to insure proper sodium cyanide additions to the bath.—V. E. Hillman and E. D. Clark, Houghton's *Black and White* October.

IDEAS · FROM · PRACTICAL · MEN

The department, "Ideas from Practical Men," is devoted to the exchange of information on methods useful to the machinery industries. Its scope includes all divisions of the metal-working industry, from drafting room to shipping platform. Descriptions of methods or devices that have proved their value are carefully considered, and those published are paid for. The rates are from a minimum of five dollars upwards, depending upon their merit

Materials-Handling Equipment for a Centerless Grinder

By George H. Feltner

An ingenious conveyor system for feeding rollers through a centerless grinder is illustrated in Fig. 1. The rollers are steel, turned, case-hardened, and then ground to $1\frac{5}{8}$ in. in diameter, with an overall limit of 0.00045 in. Approximately 0.006 to 0.009 in. of material is removed from the diameter in three operations. The first grind removes 0.004 in., the second 0.002 in., while the third sizes the work to the diameter specified. As the rolls pass through the machine after having been rough ground, they slide on to the inclined conveyor at the right which transfers them to the chute *A*, by which they are carried back to the front of the machine. The inclined conveyor is driven by a chain through gearing attached to the feed spindle of the grinder. The speed of the conveyor is synchronized with the feed of the machine, so that the rolls fall into the pockets of the conveyor at uniform intervals.

A front view of the grinder is shown in Fig. 2 illustrating the feed trough at *B*, the revolving work carrier at the left and the return chute in the background. The operation is started by filling seven of the eight work sections of the revolving carrier with rolls ready to be ground, and then by placing the rolls from one section in the feed trough, whence they pass through the machine, up the inclined conveyor, and down the chute to the empty carrier section. When the work from a section of the carrier has been run through, the carrier is revolved an eighth of a turn, so that the rolls in the next section will be in position for feeding to the grinder.

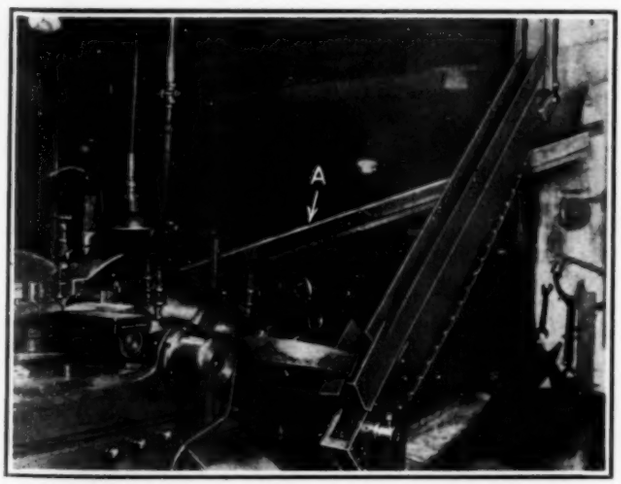


Fig. 1—Centerless grinder arranged with devices for handling the work

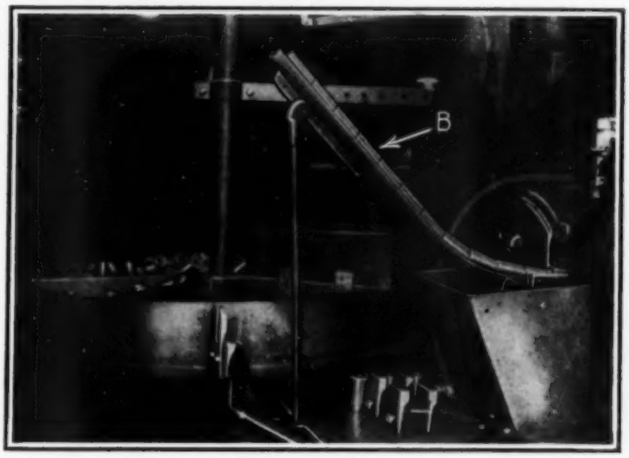


Fig. 2—Front view of centerless grinder, showing the revolving work-carrier

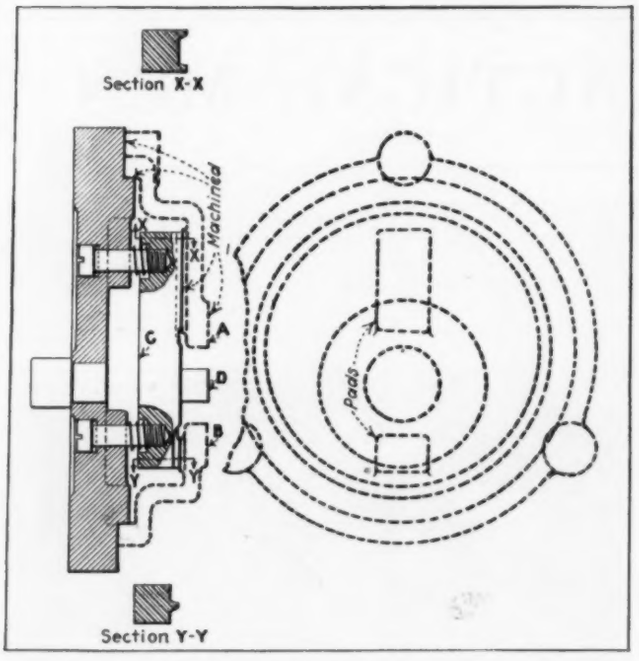
After being ground they are returned to the carrier section previously emptied. After the first rough grind has been completed, the machine is reset to suit the second rough grind which is handled in the same way. Upon completion of the final grind, the finished rolls are placed into tote boxes and delivered to the inspector. The work carrier holds approximately 600 pieces, and the average production of finished rolls is 1,200 pieces in 8 hours. The work, having a 90 scleroscope hardness, is ground wet. At the lower central portion of the illustration may be seen the built-up limit snap-gage used in checking the finished rolls. The equipment is in use at the Miehle Printing Press & Manufacturing Company, Chicago.

Fixture With Size-Block for Setting the Tool

By J. E. Fenno

The faceplate fixture shown in the illustrations is used in facing the surface *A* of the cover shown in heavy dotted lines. The distance *B* is held very close, while all other finish dimensions have a tolerance of $\frac{1}{64}$ in., excepting the rabbet diameter. In order to set the facing tool accurately it was necessary to provide some special means to measure from the finished surface of the pads. This was accomplished as follows:

The hardened tool steel bar *C* is confined by screws which are a sliding fit in the fixture proper. Stiff springs provide sufficient pressure to keep the ground surface of the bar solidly against the pads. The center of the bar forms the surface from which the facing tool may be set by the aid of the size block *D*. The sections x-x



Size block for tool-setting incorporated in fixture

and y-y illustrate the three-point bearing of the bar against the pad surfaces, thereby insuring a square contact in order that the size block may function properly.

I may add that it is evident that the operator by accident cannot run the facing tool against the size block with any damaging effect, or otherwise disturb the tool setting, as the bar will immediately move back through the action of the spring behind it.

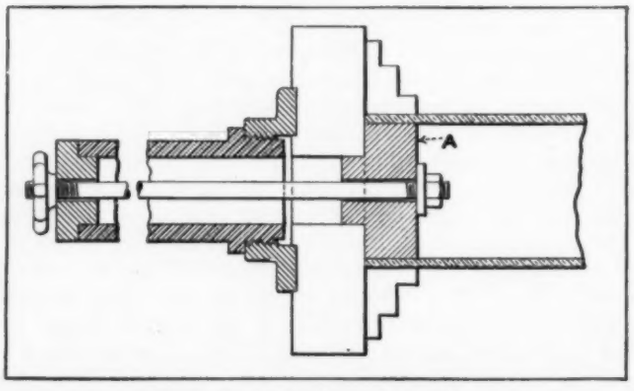
Holding Thin Tubing in the Lathe Chuck—*Discussion*

By H. M. Hunt

The method of chucking thin tubing described by H. Moore on page 512, Vol. 69, of the *American Machinist*, was very ingenious. However, I think the method used in our plant is much better and more accurate.

Referring to the illustration, the projection on the left of the plug *A* is a snug fit in the hole in the body of the chuck, and is held in place by a draw-in rod through the spindle. The larger part of the plug is turned to fit the tubing and is faced so as to be flush with the outer ends of the chuck jaws.

With one end of the tubing held on the plug by the chuck jaws, and the other end held in the steadyrest, work of almost any kind can be done upon it without danger of its slipping.



Method of chucking thin tubing

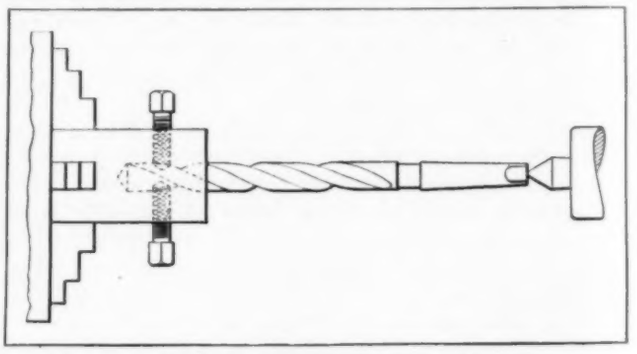
Salvaging Taper-Shank Twist Drills

By H. L. Wheeler

In some shops, taper-shank twist drills are subjected to very severe service and in time the shanks get into such bad condition that they are not fit for service. The drills otherwise may still be good for much longer life. The shanks get bent or burred and bruised so that they will not fit the taper sockets, and the tangs get twisted off so they will not drive. Any attempt to use these drills will be attended by difficulty and loss of time, to say nothing of the damage done to sockets and machine spindles. The drills accumulate and are handled over many times. They take up storage space but are seldom used.

One way to salvage these drills is to turn the shanks straight, so that they may be used in drill chucks, or to turn the shanks down to the next size taper whenever this is possible. This job is often slighted, owing to the difficulty and time required to chuck the cutting ends of the drills so that they will run true. Certain sizes in 8ths and 16ths, of course, can be held in spring chucks, but there are the odd sizes in 64ths and 32ds that have to be handled in some other way.

A simple and easy method of handling a batch of drills of varying sizes, is to chuck a piece of cast iron in a



How the drills should be held

three- or four-jawed chuck. If there are a lot of drills to be fixed up in this way, arrange them according to size. Start with the smallest size, and drill or bore a hole in the cast-iron piece, which should first be drilled and tapped for two $\frac{3}{8}$-in. setscrews. Allow it to project from the chuck jaws about 2 in. Drill the hole about 2 in. deep but not all the way through the casting. Insert the drill in the hole, which is presumed to run true, against the bottom.

If the original center is still intact, the end may be supported by it providing it runs true. If it does not, run the end, just back of where the flutes stop, in the steadyrest. Cut off the broken end and recenter the drill. Then remove the steadyrest and turn the shank straight, leaving the diameter as large as the stock will allow. The drill is driven by the two setscrews in the chucked piece which should enter the flutes of the drill. The illustration shows the scheme. Enlarge the hole for the next-size drills, and treat each one the same way, taking each size in turn. This is a much faster and easier method of truing up twist drills than by holding them in a lathe chuck.

Pulling Camshaft Bearings Into Place

By Chester H. Franklin

Forcing, or pulling, camshaft bearings into place presents quite a problem in some motor shops. In the shop of the Hupp Motor Company, where its 6-cylinder engine is built, the four camshaft bearings are pulled into place at once in the manner shown herewith. The cylinder

Pulling camshaft bearings into place

block is inverted in the position indicated, and the four camshaft bearings are slipped on a long mandrel, each bearing abutting a shoulder. The mandrel, handled by the man at the left, and carrying the bearings, is pushed into the crankcase until the bearings are near their seat.

The end of the mandrel is then fastened by a key to the head of the pulling machine at the right and the admission of compressed air to a cylinder, sets the machine in operation. In this way all four of the bronze bearings are seated at one time, after which the mandrel is removed and reloaded for the next cylinder block.

Identifying High-Speed Drills

By Joseph Bell

Around the machine shop are found many conditions which make for confusion. In most cases a little thought does wonders in avoiding mixups resulting in loss.

For example, one plant manager found that in his machine shop carbon and high-speed drills would invariably get placed in the same drill stand. They were so nearly alike in appearance that only by careful scrutiny could one distinguish between the two kinds. The workman seldom knew which kind of steel he was using after the work had been started.

As simple a thing as painting the upper half of the high-speed drills with red was enough to eliminate this expensive uncertainty. After that was done, the machinists used proper care in putting the high-speed drills to the use for which they were intended.

The man in charge of a machine shop need not revolutionize his plant in order to better its operation in a hundred small ways. All he need do for a starter, is to walk through the shop once a day with eyes open for details and a mind ready to suggest the necessary change.

Practical Shop Problems

Questions of a Practical Nature will be answered in this column

Lubricating Ball Bearings

Q. We have a ball bearing about 1½ in. outside diameter running at 6,000 r.p.m. How would a fairly heavy mineral oil with a little graphite added function as a lubricant under these conditions? What we desire is a lubricant that will adhere to the balls under the great centrifugal force.

A. A fairly heavy mineral oil with a little graphite added would be detrimental to the proper operation of such a ball bearing. In the first place, a heavy oil is too viscous, and would result in considerable heat due to the churning action. Furthermore, since the ball bearing is run with only a very small clearance between the balls and the races, the graphite, which tends to lump, would dent the races when the balls pass over the lumps.

What most ball bearing companies consider good practice in this application would be to use a very light mineral oil, and to feed it to the bearing preferably through a wick. This wick should have one end dipping in a supply well of oil and the other end bearing against the shaft at a point close to the bearing. Besides regulating the flow of oil, the wick acts as a purifier since all sediment will be strained out. At this speed even a fine mist of oil is sufficient lubricant, and the wick would transmit sufficient oil to make up for that lost through leakage.

Detecting Cracks in Metal

Q. We understand that fine cracks can be detected in metal by whitewash. How can it be done?

A. The method is usually applied to axles, camshafts and similar parts that have been in service, to detect fatigue cracks which may later result in failure of the piece. For example, before a large broken crankshaft is welded, the remainder of the piece is examined to see whether a repair is worthwhile, for if other cracks have developed, the job would naturally be abandoned.

A mixture of whiting in alcohol is first prepared, making it the consistency of thin paint. Whiting is chalk or calcium carbonate, finely ground. The part to be examined is wiped clean and then painted with this mixture which dries quickly due to the evaporation of the alcohol. If a crack is present it will show up readily due to discoloration of the whiting by the oil that is retained in the crack. If the axle or crankshaft has not been in service, it can be first swabbed with oily waste, then dried and painted. Cracks otherwise invisible to the naked eye can be detected in this manner.

Tinning Copper Disks

Q. We want to coat with tin one side of some sheet copper disks 6 in. in diameter. How can this be done?

A. After cleaning the sheets well, arrange to heat them from underneath, either electrically or by setting them on a block with a flame below. When hot, the top surface should be rubbed over with a flux of ammonium chloride. The tin is put on the heated surface in small pieces and rubbed with a wad of cotton waste. This will give a uniform coating.

American Machinist

Editors: KENNETH H. CONDIT AND FRED H. COLVIN

Established 1877

The "Antiquated" Inch and the Compulsory Meter

ONCE more we are told, and by no less a personage than Aubrey Drury, director of the All-American Standards Council, that our foreign business is sadly handicapped because we cling to an obsolete "rule-of-thumb" system of measurement. Mr. Drury is shocked "that we are yet governed in trade transactions by crude weights and measures which are survivals of barbarism," and goes on to show how an inch may have been the length of some king's knuckle-bone. His whole tirade, which occupies two and a half columns of a Sunday paper, shows very clearly that he has little knowledge of measurement, or of the importance of accuracy in manufacture.

So far as measurement goes, it matters little whether the original inch was taken from King Arthur's thumb, or the meter from the hind leg of a mule, so long as they are so standardized that they can be reproduced with sufficient accuracy to meet the requirements of modern manufacturers.

Even if, as Mr. Drury assumes, the meter had divine or even scientific origin, its value would depend on how well it served the needs of business. Proposed by the French at a time when their chief aim in life was to upset all that had gone before, and supposed to be a definite fraction of the earth's circumference, the actual length of the meter is as much a mongrel as the alleged length of the king's knuckle-bone. All claims to a logical or scientific basis are as futile in one case as in the other. Nor is its base or origin important in any way. Nothing but its usefulness to man, through industry, should be considered.

If, and when, anyone wants to use the metric system, he is free to do so without the enactment of any legislation. If those who would be most affected felt that the metric system offered sufficient advantages to warrant the expense of its introduction, they would have "gone metric" years ago. Until they do, all efforts to compel its adoption should be fought vigorously. Our present experience with compulsory enactment, for the good of the other fellow, can hardly be called a complete success after nearly ten years of expensive effort.

In the meantime, it is well not to get excited over such phrases as "rule-of-thumb measurement" that are "survivals of barbarism" and other alleged witticisms. With the two great English-speaking countries who still use the antiquated inch building probably 80 per cent of the world's best machinery, and exports showing no sign of decreasing as a result, it would seem that our metric friends were a bit over-solicitous.

But unless you want the metric system forced on you—see that the Tillson Bill is defeated.

A Sign of the Times

HALF of the output of one machine tool building company is being sold at the present time to other machine tool builders. There are several inferences to be drawn from this condition of affairs. One is that the builders of machine tools could exist comfortably by selling their output to each other. Which, of course is only partly true. Another is that they are finally taking to themselves some of the advice they have been giving their customers these many years. Which is true, but no reflection on them because most of them have only been prevented by lack of cash from doing the same thing long ago. From which it may finally be inferred that because they are buying new equipment they have some money; and that because they have some money business must be pretty good; and that because business is good with them it must be even better in the metal working industry which buys from them, for the reason that their business always trails behind on an upswing.

Lubrication of Machines

PROPER lubrication of machinery probably presents one of the greatest opportunities for economies in manufacturing costs to be found with present-day equipment. Not in the saving in cost of the lubricant itself, as that is frequently an expensive experiment, but rather in getting a sufficient quantity of the right kind of lubricant to the bearings at the proper time. It is far cheaper to waste an appreciable percentage of the lubricant than to starve bearings with too little oil.

Knowing the proper amount of lubricant for each bearing and applying it regularly, is a problem for the lubricating engineer. It is also within his province to specify the type and grade of lubricant to be used.

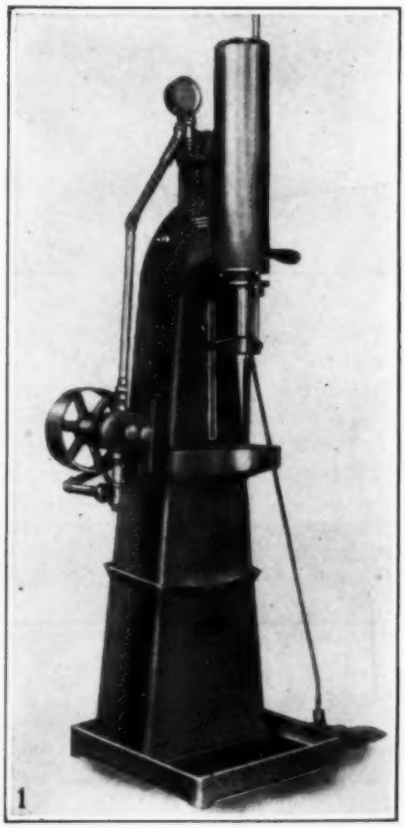
· SHOP · EQUIPMENT · NEWS ·

American Type V-1, 2-Ton Vertical Broaching Press

BROACHING, push pressing, and arbor pressing are among the operations which can be performed on this 2-ton press developed by the American Broach & Machine Company, Ann Harbor, Mich. The machine, as shown in Figs. 1 and 2, may be either belt or motor driven, and is operated by oil pressure. It is controlled by a hand lever and foot pedal, and is so arranged that immediately upon release of either lever the ram returns automatically to the top position.

This broaching press has a stroke of 14½ in., a ram diameter of 2 in., and the end of the ram is tapped ¾ in., 16 threads per in., to receive the attachments for pushing. The work table is bored 2¾ in., central with the ram, and the front of it is cast with a notch which may be cut through into the bore in cases where it is desirable to have such an opening to facilitate the removal of assembled parts. Work up to 10¼ in. in diam. can be handled, and the table surface is 8 in. in diam. The press is provided with a 4-in. cylinder, which is made of special gray iron, accurately bored. The piston used is of the conventional type, having step joint rings and one leather cup.

Oil is delivered by the pump to the full area of the piston on its downward stroke. Return of the ram is made at 25 per cent increase in speed over the downward stroke. The pump is of the continuous-flow type, and the control of the ram is by means of a balanced piston valve. The oil reservoir is situated in the frame proper, and holds approximately 5 gal. The pump works at a maximum pressure of 400 lb. per sq.in., and a direct-reading gage is supplied. A relief valve is included, which can be set at any pressure required up to the limit. The machine, when belted so that the drive pulley runs at 600 r.p.m., gives a working speed at the ram of 14 ft. per min., but the drive pulley can be operated at speeds as high as 1,200 r.p.m., with proportional increases in the ram speed.



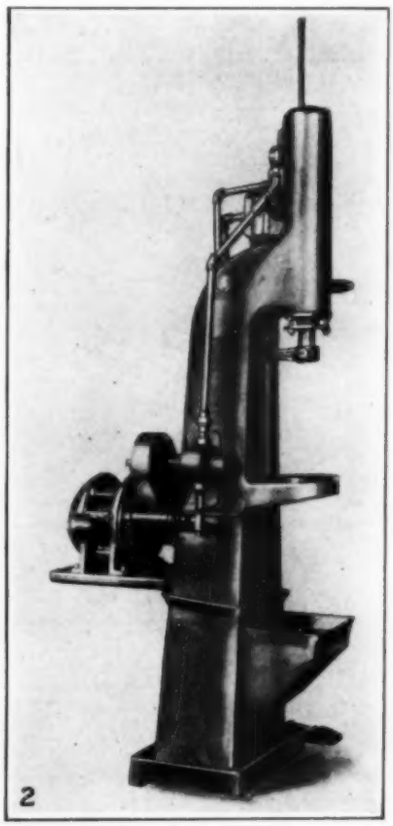


Fig. 1—American Type V-1, 2-Ton Vertical Broaching Press of the belt-driven type. Fig. 2—The same press, but motor-driven

De Walt Bandsaw

Capacity to handle material up to 7 in. thick and a throat depth of 20 in. are furnished in the portable bandsaw manufactured by the De Walt Products Company, Leola, Lancaster County, Pa. As shown in the illustration, the saw blade is completely covered except for 8 in. exposed at the cutting point. The saw travels around three pulleys, the rear one being driven by a V-belt from a ½-hp. motor. The pulleys are ball-bearing mounted.

De Walt Bandsaw that handles material 7 in. thick and has a throat depth of 20 inches

The work table is 13⅜ in. square, and has a graduated sector to show the amount of tilt. The table tilts right 45 deg. and to the left 3 deg., table stops being provided to bring the table exactly to the horizontal position. The tracking device is placed in the upper head to adjust the rollers so that the saw travels centered over the rollers. The ma-

chine is built upon a base which may be attached to a floor stand or placed on a bench. Standard equipment includes two bandsaw blades, $\frac{3}{8}$ and $\frac{1}{2}$ in. wide, respectively. The weights of the motor-driven bandsaw complete with motor and floor stand is 210 lb., and without the motor and floor stand the weight is 120 pounds. The machine can be arranged for belt drive.

Ruxton "Multi-Vider" Pencil

The Ruxton "Multi-Vider" pencil illustrated is a combination slide rule and automatic pencil, and is made by the Ruxton Multi-Vider Corporation, 2445 Graybar Building, New York, N. Y. Its overall length is $6\frac{1}{2}$ in. and it measures $\frac{7}{16}$ in. across the flats of the hexagon barrel so that it can readily be carried in the vest pocket.

With it rapid calculations can be made involving multiplication, division, percentages and proportions with sufficient accuracy for estimation purposes, and the result can be written down with the pencil in the hand. It is recommended for engineers, architects, contractors and businessmen who have estimates to make. A simplified instruction booklet is furnished with each Multi-Vider pencil so that those unfamiliar with the slide rule can readily learn its uses.

The logarithmic scale is 4 in. long and is engraved by a precision machine. The hexagon barrel carrying the scales, of which there are four, is made of Bakelite for lightness and durability, and is split in half. The two halves slide in relation to one another by means of a metallic strip and groove on the inside of the hollow hexagon halves. Two pairs of scales are used, one the inverse of the other, to compensate for the fact that the scales can be separated in only one direction from the initial position, whereas in an ordinary slide rule the movable scale may be slid either to the right or to the left from the initial position. It is only necessary to roll the pencil while held in the fingers to obtain readings on either sets of scales.

The outside metal parts are 14-karat gold filled, while the inside parts are made of spring brass, nickel-plated. The pencil movement is controlled by a movable sleeve at the lower end located between the cone tip and the barrel. It propels the lead positively in either direction by rotation of the sleeve. At the other end of the pencil is a large-size eraser covered by a gold-plated cap when not in use. Inside the barrel is a reservoir for leads.

Clayton & Lambert Improved No. 32 Torch

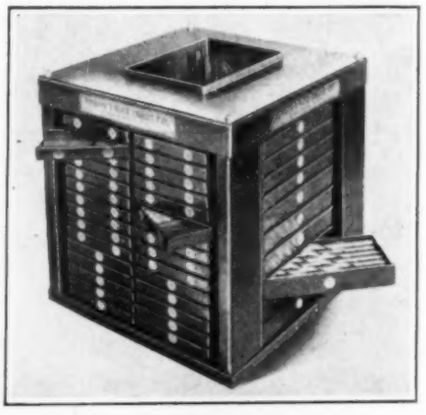
A powerful burner has been built into the improved No. 32 torch developed by the Clayton & Lambert Manufacturing Company, 6282 Beaubien St., Detroit, Mich. The torch will burn the lower grades of fuel, and is not affected by wind or cold. The burner is self-cleaning.

The valve seat is away from the orifice in the jet block, hence it is impossible to enlarge the orifice by forcing the needle into it. A wire tip attached to the needle passes through the orifice every time the valve is closed, thus cleaning away any accumulation of carbon and insuring free passage of gas and maximum heat when in use. The tank is balanced, and is made of heavy-gage drawn brass reinforced both inside and out.

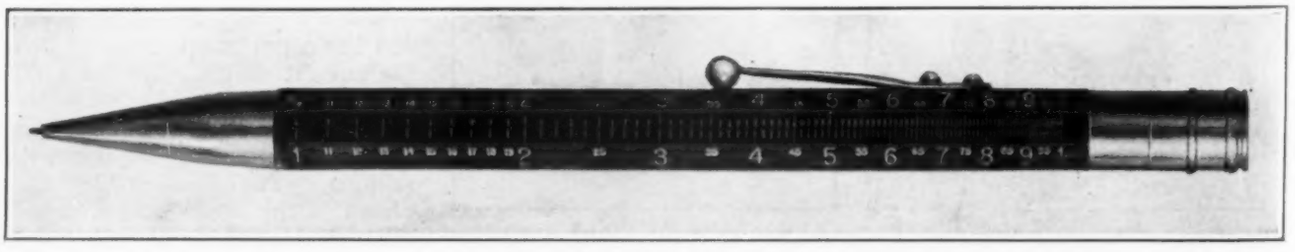
Clayton & Lambert Improved No. 32 Torch

"Ideal" Drill Case

Wire size drills from Nos. 1 to 80 inclusive, and jobbers' drills from $\frac{1}{32}$ to $\frac{1}{2}$ in. by sixty-fourths of an inch, may be stocked in the "Ideal" drill case, which has been placed on the market by the Union Twist Drill Company, Athol, Mass. Bit stock drills may be kept in the top of the case, this portion being formed in a deep well. All drills are protected from dust and dirt, and excessive handling of stock is eliminated. Each drill size is marked by a non-corroding, two-color metal plate fastened to the drawer and stamped in legible figures. The drawers holding wire size drills are arranged so that odd-numbered drills are in one vertical column and even-numbered drills in the other. This construction facili-



"Ideal" Drill Case



Ruxton "Multi-Vider" Pencil

tates putting the drills into the drawers quickly and without error.

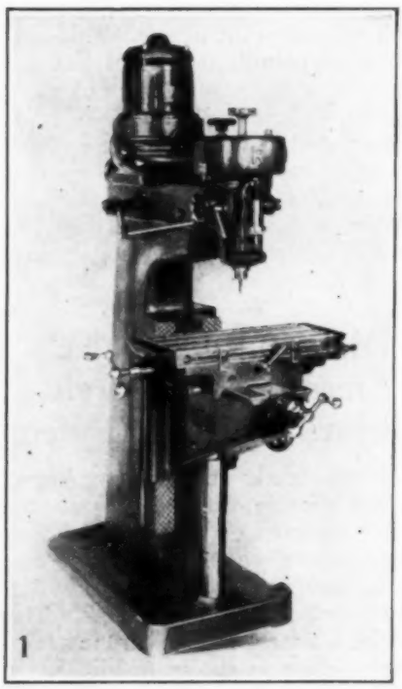
Each drawer is made of one piece of sheet steel and swings at one corner. It can be pulled out so that all of the contents are easily seen, it cannot be dropped, and the drawer cannot spill. The entire case, inside and out, is finished with olive-green lacquer. The case is less than 14 in. high and each side is 12 in. wide. The weight is 38 lb., net.

Gorton No. 8-D Vertical Milling and Routing Machine

DIE work and routing in brass, steel and cast iron can be handled on the No. 8-D vertical milling and routing machine, which has been placed on the market by the George Gorton Machine Company, Racine, Wis. Ten spindle speeds, whicl range from 475 to 3,000 r.p.m., are obtainable without back gears or changing pulleys. Higher speeds up to 6,000 r.p.m. are available for brass routing and when diamond tools are used. The machine will drive a $\frac{1}{2}$-in. high-speed steel cutter. Vertical movement of the spindle on machines equipped for brass routing is effected by means of a foot treadle not shown. Fig. 1 shows the mechanism to which the treadle is attached, while Fig. 2 illustrates the operating mechanisms.

The sliding head, when close to the column, permits a gap between the column and the spindle of 15 in., whereas when fully extended the gap is 30 in. As the table transverse movement is 22 in., the area of the working surface is 15x22 in. for one setting of the work. The maximum distance between the spindle and the table is 15 in., and the minimum is 0 inches.

A spindle pulley brake facilitates cutter changes. Power is delivered from the $\frac{3}{4}$-hp. ball-bearing motor to the spindle by means of step pulleys and a V-belt. The spindle is inclosed and also runs on ball bearings. It is machined from a solid chrome-manganese steel bar, hardened, and then ground inside and out. The spindle is splined, and is mounted in a sleeve of the same material. The sleeve slides in a hardened and ground steel bushing. For brass routing besides the foot treadle, the machine is also equipped with a chip blower integral with the motor, and a forming attachment for cutting curved surfaces.



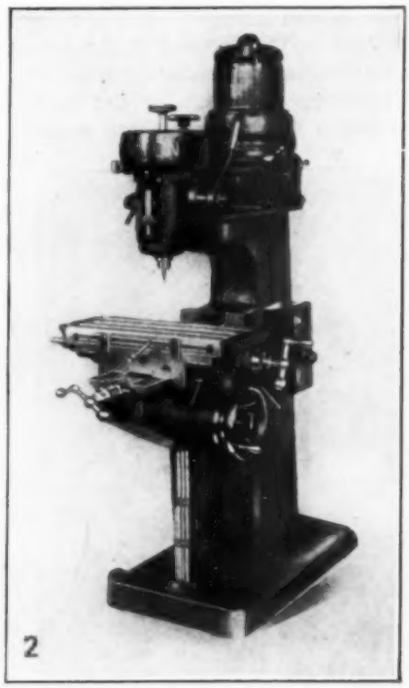


Fig. 1—Gorton No. 8-D Vertical Routing and Milling Machine. Fig. 2—View showing the operating mechanisms for the table and head

Hoskins Type FR Box and Pot Furnaces

Five box types and one standard pot type of the "FR" furnace have been placed on the market by the Hoskins Manufacturing Company, Lawton Ave. at Buchanan St., Detroit, Mich. The box furnace illustrated in Fig. 1 is available in standard cross-sections as follows: 12x8 in. in lengths of 18, 27, and 36 in., and also cross-sections: 20x13, 28x13, 28x21, and 28x29 in. in any length up to 8 ft. in increments of 1 ft. These furnaces can also be had equipped with pusher mechanisms

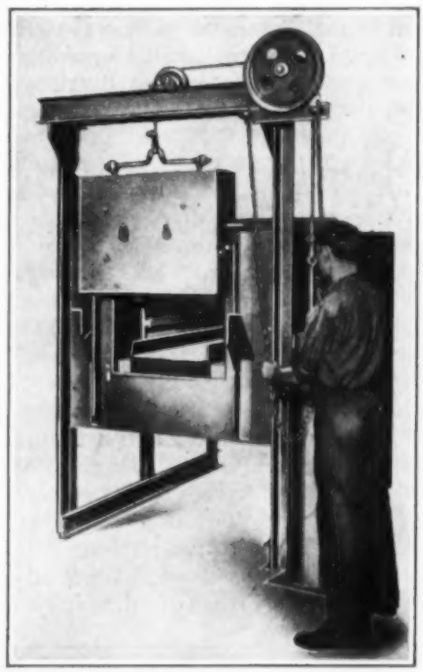


Fig. 1—Front view of the Hoskins Type FR Box Furnace showing side wall heating elements and protecting insulation

and conveyor-type quench tanks. The ratings of the box-type furnaces range from $12\frac{1}{2}$ to 70 kw. The standard pot-type furnace accommodates a 15x15-in. container, suitable for babbitt, tin, lead and cyanide. The maximum safe temperature for the FR furnaces is 2,000 deg. Fahrenheit.

In Fig. 2 is shown the easily renewed ribbon heating element which slides in and out. The furnace operates directly on the line without a transformer, and the current density of the ribbon units ranges from 6 to

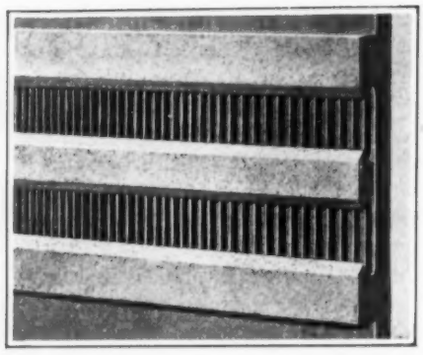


Fig. 2—Close up of the "Chromel" heating ribbon and protecting insulation

9 watts. The "Chromel" floor plate is in one piece, and gives continuous hearth surface and complete protection to the floor units. Chromel ribbon units are placed on all four sides, thus causing uniform heat distribution.

Elwell-Parker Crane "Lift-Tructor"

Loads weighing up to 1,500 lb. may be hoisted onto a skid by the crane and the skid with a total load of 6,000 lb. then transported to the desired point by means of the "Lift-Tructor," which has been placed on the market by the Elwell-Parker Electric Company, Cleveland, Ohio. The electric crane hoist motor receives its power from the same battery that drives the tractor, and operates the platform lift motor. Three motors are used, all being Elwell-Parker of the fully-inclosed type. Crane loads may be picked up over the end of the platform or 90 deg. to either side, and the skid load may be transported at a rate of 3 to 5 miles per hour.

The crane proper swivels on ball or roller bearings, and the boom may be raised or lowered by power. The inclosed, horizontal-drive motor is located beneath the battery compartment just forward of the operator, all control levers being within easy reach. The drive motor delivers power through drop-forged gears and a phosphor-bronze wormwheel to the rubber-tired drive wheels, which are 22x4½ in. The trail axle is fitted with two or four 10x5 in. rubber-tired wheels as service conditions dictate. Steering connections through the four or six wheels are of the ball and socket type, and are set high enough into the frame to afford ample clearance for rough roadway, or inclined crest conditions. The center of gravity is very low, because of the heavy underframe construction and the low-slung actuating mechanisms.

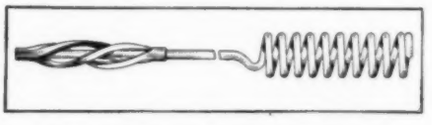
A crane tractor is also available for hauling trailers and at the same time providing facilities for loading the trailers drawn behind. When the tractor is not used for towing purposes its 41x80-in. fixed platform is available for direct loading up to 6,000 lb. The crane, which is of the revolving and luffing type, has a capacity of 1,200 lb., and is provided with a double-drum hoisting unit for lifting either the boom or the hook. The motor for driving these drums is supplied from the same battery as for the tractor propelling motor.

All Elwell-Parker safety features, including the alloy-steel driving mechanism, are employed in its construction. The unit is particularly useful in transporting heavy castings from the yard and placing them on the particular machine tool required to finish them.

Elwell-Parker Crane "Lift-Tructor" that will lift crane loads of 1,500 lb. and transport skid loads of 6,000 pounds

Scully Ruggles "Perfection" Valve-Guide Cleaner

Carbon can be removed from valve guides by means of this cleaner, which has been placed on the market by the Scully Steel & Iron Company, 2364 South Ashland Ave., Chicago, Ill. The spiral blades shown at the left of the illustration take long shearing cuts in removing the carbon. The cleaner is self-sharpening, the blades being so shaped that the cutting action keeps them sharp. The



Scully Ruggles "Perfection" Valve-Guide Cleaner

front ends of the blades are attached to the end of the handle and the rear collar rides on the handle. This construction permits the use of one size of cleaner for several sizes of valve guides. The handle is made of cold-rolled steel with spring grip, plated to resist rust. Four sizes are manufactured. The ranges are from 0.296 to 0.338 in., from 0.340 to 0.392 in., from 0.400 to 0.500 in., and from $\frac{9}{16}$ to $\frac{5}{8}$ inch.

Direct-Reading Attachment for Pittsburgh Brinell Hardness Testers

Limit marks on the graduated screen of this direct-reading attachment are intended to show quickly to the operator whether or not the material under production test is within the specification for hardness. The device is attached to the hardness testing machine as shown in Fig. 1. It is imported from Germany by the Pittsburgh Instrument & Machine Company, 1026 Reedsdale St., Pitts-

Fig. 1—Direct-Reading Attachment applied to a Pittsburgh Brinell Hardness Testing Machine

burgh, Pa. The power-operated hardness tester shown in Fig. 1 is an improved model of the machine described on page 594, Vol. 61, of the *American Machinist*.

The screen shown in Fig. 2 has a glass scale upon which the shadow image of the ball impression is cast by the optical arrangement. The shadow lines show the diameter of the impression while the load is ap-

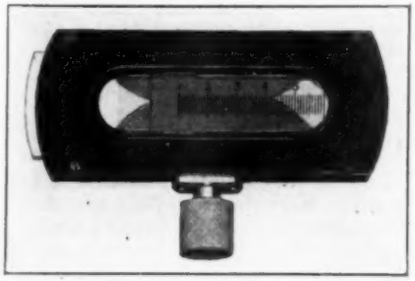


Fig. 2—A view of the screen and movable glass scale of the Direct-Reading Hardness Testing Attachment

plied, in this case by means of a 10-mm. ball. A small knurled knob on the screen is used to slide the glass scale so that the intersection of the arcs at the left is at zero. The diameter of the impression is then read from the scale. Production testing is thus permitted, due to the ease of operation, if the surfaces under test are well finished.

Link-Belt Increases Standard Silent-Chain Drive Sizes

The range of sizes of standard silent chain drives stocked by the Link-Belt Company, 910 South Michigan Ave., Chicago, Ill., has been increased so that drives from ½ to 60 hp. are now available for immediate delivery, whereas heretofore stock sizes varied only from ½ to 15 hp. Practically any reduction up to 7 to 1 for drives up to 60-hp. capacity may be chosen direct from Catalog 725 by the customer.

"Fleet-Weld" High-Speed Welding Rod

An extruded welding rod which permits high-speed welding while retaining the ductility of the weld has been developed by the Lincoln Electric Company, Cleveland, Ohio. According to the manufacturer, the speed of welding has been doubled or trebled by the use of this rod without obtaining porosity of the welded metal. High ductility and deep penetration are other features of welds produced with this rod.

Gits High-Pressure Grease Gun and Fittings

Pressures up to 3,000 lb. per sq.in. can be exerted on lubricants by means of this hand compressor, which has been developed by the Gits Bros.

Fig. 1—Gits High-Pressure Grease Gun

Manufacturing Company, 1,940 South Kilbourn Ave., Chicago, Ill. It is understood that pressures up to 10,000 lb. per sq.in. can be obtained by using a compound compressor of the leverage type. The capacity of the gun, shown in Fig. 1, is 8 oz. of lubricant, and when full the total weight is 2¾ lb. Lubricants ranging from those as light as kerosene to greases as heavy as No. 5 cup grease can be handled.

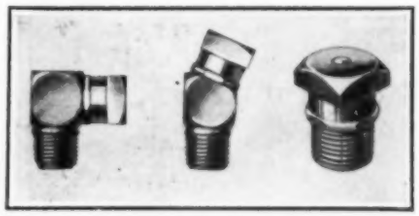


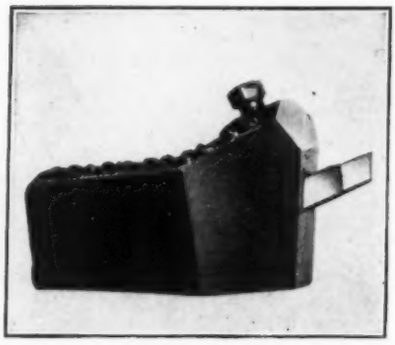
Fig. 2—Types of the Gits High-Pressure Grease-Gun Fittings

Fittings used with the gun are of the low-setting type. Three types are illustrated in Fig. 2. In some cases the height from the end of the thread to the top of the face does not exceed ¾ in. All fittings are case-hardened and fit snugly into the machined nozzle of the compressor. A short turn of the gun to the right gives a leakproof connection, as the valve in the nozzle seats on the fitting. While it is seating, the nozzle valve opens. Turning the sliding hand lever causes the lubricant to be forced through the fitting and into the bearing. After sufficient lubricant is used, a short turn of the gun to the left disengages the gun and the check valve closes.

The compressor body is made of seamless steel tubing expanded at the handle end so that the leather cup may be withdrawn without injury. The overall length when filled with grease is 19½ in. and the length from the nozzle to the top of the barrel is 13 in. The fittings are turned from solid bar stock, and are furnished in both straight and angle types.

Ready Toolbit Grinding Fixture—*Erratum*

The illustration shows the Ready toolbit grinding fixture, made by the Ready Tool Co., Bridgeport, Conn., in its correct position. In the article under the above title that appeared on page 519, Vol. 69, of the *American Machinist* the tool was shown in a tilted position in order to make its construction clear, but it misled some readers into thinking the device could accomplish objects for which it was not intended. The toolbit fixture is actually used on the tool rest of a tool grinder, and the toolbit is held in such

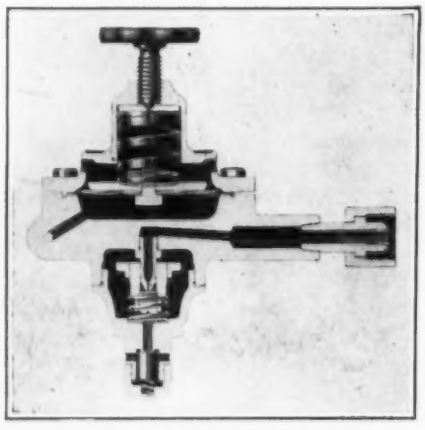


Ready Toolbit Grinding Fixture shown in operating position

a position that a clearance of 7 deg. is obtained on the front when the bit is replaced in the toolholder. With the fixture in the position shown the front and side of the bit can be ground; when the fixture is turned through one-quarter turn the top can be ground.

Torchweld Oxygen Regulator with Safety Release Valve

Excessive pressures built up in oxygen tanks can be avoided by the use of this regulator, which incorporates a safety release valve. The device has been placed on the market by the Torchweld Equipment Company, 224 North Carpenter St., Chicago, Ill. The safety valve is fitted to the back cap of the regulator, and is automatic in operation. It can be put on all Torchweld regulators now in use. When the oxygen pressure becomes excessive in the regulator body, the safety valve permits gas to escape through an opening in the back cap until the pressure is again normal. As shown in the illustration, the safety feature is simple, consisting only of a spring plunger seating on a machined surface in the back cap, a plunger, and the valve cap.



Torchweld Oxygen Regulator with Safety Release Valve

The regulator body is provided with a three-ply diaphragm of the self-centering type. The diaphragm is provided with a simple means of maintaining uniform tension. Sturdy brass forgings are used in the construction of the regulator.

Trade Catalogs

LATHE, AUTOMATIC. The Sundstrand Machine Tool Co., Rockford, Ill., has published a catalog entitled "For Faster Turning," which develops the design and construction of the Sundstrand automatic lathe in a most interesting manner. After giving the background and reasons for the design, the construction features, such as using cams for the feeds, are presented, together with photographs on which the figures of little men are used to point out the exact location of the various features described. This usage provides both an interesting and exact means of bringing out the important points. The control of the feeds and traverses are taken up, and finally the general design is described and the specifications are listed. The catalog is printed in color and contains 24 11x8½-in. pages.

FLEXIBLE SHAFT EQUIPMENT. The Stow Manufacturing Co., Inc., Binghampton, N. Y., has published a catalog containing engineering data and illustrations of flexible shafts and flexible shaft machines. Among the machines listed are the Stow gasoline-driven unit, "Lindy" assembly, portable grinder, bench grinder, and many attachments. Specifications and dimensions for nearly all products listed are given. The catalog contains twelve 11x8½-in. pages.

METAL CLEANERS. E. F. Houghton & Co., Third, American and Somerset Sts., Philadelphia, Pa., has published the second edition of its pamphlet entitled, "Houghto-Clean for the Metal Working Industries" which is a brief outline describing the use of cleaning materials for metal-working plants. Cleaning metal in tanks, and by means of metal-washing machines, steam guns, electric cleaners are all taken up in order as well as cleaning before plating, removing quenching and tempering oils, and cleaning floors. The metal cleaner for each case is specified. Several illustrations are provided. The catalog contains 34 9x6-in. pages.

SPEED REDUCERS. The D. O. James Manufacturing Co., 1114 West Monroe St., Chicago, Ill., has published Catalog No. 166, which describes, illustrates and lists completely every type of speed reducer made by the company such as planetary spur, direct, angle and vertical drives, heavy-duty worm direct and angle drives, medium-duty worm direct and angle drives, and herringbone direct and angle drives. This book is written and compiled in a concise, well-illustrated form which makes it suitable for easy reference. It is profusely illustrated throughout both by means of photographs and special diagrams. The catalog contains 160 10½x7-in. pages.

TUMBLING BARRELS. The Ideal Industrial Machinery, Div. of Consolidated Concrete Machinery Corporation, Winton Place, Cincinnati, Ohio, has published a handsomely printed catalog on its line of machines for tumbling, separating, treating, washing, burnishing, painting and pickling metal parts. All equipment for these various operations is built up from standard units. The catalog is illustrated and the operations performed are clearly described. Other machines described are a blast drier, a power loader, a chip separator, and a batch mixer. The catalog contains 31 11x8½-in. pages.

Pamphlets Received

SIMPLIFIED PRACTICE RECOMMENDATIONS. The U. S. Department of Commerce, Bureau of Standards has issued a series of simplified practice recommendations for the elimination of waste. They are as follows: R 20-28—Steel Barrels and Drums; R 30-28—Roofing Ternes; R35-28—Steel Lockers, (Single, Double and Multiple Tier); R 43-28—Paint and Varnish Brushes, and R 71-28—Turnbuckles. Any of these recommendations can be obtained for 5 cents from the U. S. Government Printing Office, Washington.

THE SUPPLY OF OIL FUEL. The Oil Heating Institute, 420 Madison Ave., New York City, has published a bulletin entitled "What About the Supply of Fuel Oil?" The institute asserts that our petroleum reserve should prove ample for generations to come. Production of crude petroleum increased to 900,000,000 bbl. in 1927, but with the new recovery methods applied to the old fields, it is probable that the amount of oil recovered from them will reach the enormous amount of 30,000,000,000 bbl. This means that at the present rate of consumption, we will have 35 years' supply from this source alone. Since there has been a tremendous development in what might be called petroleum geology, it is very likely that new fields will be discovered constantly, offsetting to some extent present diminishing sources.

NEWS OF THE WEEK

Business No Longer "Private" Says Wm. Butterworth

Looks to business press for leadership and counsel

THE question whether the term "private business" has not become obsolete against the background of modern industry and trade was raised by William Butterworth, president of the Chamber of Commerce of the United States, in an address on Nov. 16 before the convention of the Associated Business Papers, held in New York City.

"Business," he said, "is the custodian of national prosperity. Problems and practices which affect business welfare intimately affect the nation and its people. This vests the processes of business with a public interest and entails a distinct public responsibility.

"I wonder if our business vocabulary isn't in need of revision. We yet speak of 'private' business, but progress is making that word almost a misnomer—except as a distinction between the processes of commerce and industry and those of government which we describe as public business. There was a day when the institutions of business were indeed private. That was a day when the ownership and management of business enterprises were vested in one man or, at most, in a small group of partners. But, today, literally millions of our people are shareholders in our great agencies of finance, transportation, communication, production and distribution. And the end is not yet of this widespread public ownership of business.

"With this emergence of business from the privacy of yesterday has come the conception of business as the servant of its public. It is most significant and noteworthy that with this conception business has taken on a new dignity—the dignity of higher standards of practice and conduct. Perfection has not been attained, but let him who doubts that marked progress has been made, recall these unfortunate maxims more or less in vogue in an earlier day:—'let the buyer beware' and 'let the public be damned.' The business man who still holds to these mistaken principles is the exception and not the rule.

"Awakening at length to the value of its public service and to the dignity of its place in the scheme of things, business began to assert that to serve a people's creature needs is quite as worth writing about as killing them in battle; that it is quite as romantic to furnish a people with the utensils of useful employment as to squander its heritage in warfare; that it is quite as noteworthy an achievement to house a people in comfort in city and town and upon the farm as to lay waste a country with fire and sword.

"Business fails in its greatest public responsibility if it fails itself to outlaw the trickster and his trickery, not waiting for the public, in its outraged confidence, to 'call the cops.'

"Enlightened business, eager to fulfill its destiny in the world, asks freedom of initiative. Properly so. But even paramount to individual right is the public right, and the individual who forgets that larger right must bring upon himself and his enterprises and indeed more or less upon the entire business community, outbursts of public wrath in terms of legislative and government regulation that may hamper and hamstring a legitimate liberty of business initiative. Lawless, destructive initiative must be curbed. It must be curbed in the public interest and it must be curbed in the interest of lawful business. Organized business must and is lending a willing hand to this curbing through its own efforts at self restraint and self regulation. This aspiration is most worthy and it is to the credit of the business press that it is bringing its influence more and more into aid of such efforts.

"The success of business in measuring up to its public responsibilities depends in no small measure upon the courage of its organizations and the vision of its press. The organization is the business forum; the business senate. Here business canvasses and clarifies its opinion and arrives at its decisions. The business press—if it fully measures up to its opportunity—is the 'guide, philosopher and friend,' valued in counsel, because it is as free to caution and to admonish as to approve and acclaim."

"Moreover, in the solution of many of our business problems involving the public responsibilities of business, the sympathetic attitude of government is necessary. This does not mean that business is—or should become—a petitioner for paternalistic legislation. But it is right and proper that business seek support for legislative policies that open the way for the collective wisdom of business to work out its own welfare, mindful that its largest good is always the public good.

"Thus the success of business in measuring up to its public responsibilities depends in no small measure upon the courage of its organizations and the vision of its press. The organization is the business forum; the business senate. Here business canvasses and clarifies its opinion and arrives at its decisions. The business press—if it fully measures up to its opportunity—is the 'guide, philosopher and friend,' valued in counsel, because it is as free to caution and to admonish as to approve and acclaim.

The Mission of the Press

"Let me elaborate that idea. I am a thorough believer both in business organization and in the business press. Both are potent allies of business and industry. But let me say that the business press should not content itself merely with reporting business deliberations and business decisions. It should take part in them. And in saying this I have no thought to detract from the value of the reporting function. That I know to be most valuable—that interchange of business experience. It enables me as a manufacturer in Illinois to profit by the successful method of others, and it enables me to avoid errors that have been discovered elsewhere. That, I repeat, is a service of the highest order. But as a business man, as a manufacturer, as a member of trade and business organizations, I need, too, the candid advice of the business press. The business paper with its trained observers scanning the business horizon naturally has a wider view and an even better perspective upon the inter-relation of business events and movements than either the trade association or the individual business man. The value of this detached viewpoint and of the frank and friendly counsel of the business press cannot be too highly estimated. The business press has universal contact with business, it has the opportunity to mirror business to itself, and fearlessly to advocate sound policies and win for them the approval of both business and the public.

"Moreover, never was the opportunity greater than now for the business press to make itself indispensable to business and industry. Never had it a like opportunity to stimulate leadership. For our business world is a rapidly changing world. In all its phases its processes are undergoing almost revolutionary readjustments. These require a new strategy, new tactics, new methods and, above all, unflagging fortitude and courage.

"The business press, therefore, needs,

(Continued on page 828d)

The Business Barometer

The outlook in Commerce, Finance, Agriculture and Industry

By THEODORE H. PRICE

Editor, Commerce and Finance, New York

(Copyrighted, Theodore H. Price Publishing Corporation, 16 Exchange Place, New York)

THE gamble in stocks has become a national sensation. It has grown so gigantic that many business men hesitate to accept normal commitments. Everybody knows that the rise in securities must come to an end some time, and that each day's advance brings it nearer. All the conservative authorities advise caution, and their attitude is not without effect upon merchants of experience.

The *Commercial and Financial Chronicle* says that it "views the steadily mounting figures of brokers' loans with a degree of concern that approaches alarm," and the editor of the *Iron Age* writes that "The speculative buyers of a good many stocks, as was the case with buyers of Florida lots, are going to see their high-priced acquisition shrink, for there is a top for everything."

But the speculators who have profited enormously by the advance already established disregard the counsels of the prudent, and they have succeeded in creating a veritable buying frenzy. Even the president of the New York Stock Exchange has declared himself as believing that brokers' loans are destined to supplant older forms of financing, and that any substantial reduction in their total is unlikely in the near future.

The weekly statement of the Federal Reserve Bank of New York says that loans on securities made through its member banks increased $1,849,000 last week. This and last week's increase would seem to indicate that the members of the New York Stock Exchange are now borrowing well in excess of 6 billion dollars, as their loans at the end of October amounted to $5,879,721,000. But this tells only part of the story, for there are but 1,100 members of the New York Stock Exchange, whereas many times that number are carrying the securities that are traded in on the 33 other stock exchanges of the United States and Canada as well as in the "over-the-counter" markets that have sprung up in most of our important cities.

An accurate ascertainment of the amount that is being borrowed to finance this enormous speculation is, of course, impossible, but good judges put it at between 10 and 15 billion dollars, and as the loans which compose this total can only be liquidated by re-borrowing, or a sale of the securities pledged, it is plain that a continuance of the advance means continuous expansion of credit. That such an expansion has been made possible by the imports of gold now arriving or on the way, is not to be denied, but we cannot draw gold from Europe indefinitely, and when the movement is checked, an advance in interest rates, with a corresponding decline in securities prices, would seem to be certain.

It is this certainty that makes merchants cautious, and deters distributors of goods from purchasing in excess of their immediate requirements. But this spirit of prudence is not without its advantages, for it is preventing any accumulation of merchandise, and is keeping the country's production moving into consumption with regularity and smoothness.

The carloadings for the week ending November 3 reflect such a movement. They are 6 per cent in excess of last year's figures. The October statistics on railway traffic are also encouraging. They show a decided increase in gross earnings, especially in the Northwest. These are about the only precise data by which the improvement in trade can be gaged, but there is a striking unanimity of optimism in trade reports published during the week, and there seems to be no doubt that the improvement in business is widespread and will continue unless it is checked by influences that are extraneous and unfavorable. In most lines of manufacturing activity the conditions are normal or better than normal, and the demand seems fully up to production, although there are some who complain of the meager profits left to them by competition.

An impressive feature of the situation is the comparative absence of speculative activity in the commodity markets, where the price changes are chiefly due to trade selling or buying. Rubber has not been as resilient as usual, but, at the slight decline established, the demand uncovered has been large.

But although the speculative apathy that pervades the commodity markets is discouraging to the brokers who deal in futures, it has a salutary effect upon trade, and is already increasing the flow of merchandise from consumers to producers. This is particularly true of rubber, silk and cotton. Therefore, the domestic outlook would seem to be reassuring and satisfactory.

Conditions overseas, however, are not quite so bright as they were, and they have been somewhat complicated by the international debate over disarmament. The speech that President Coolidge delivered on Armistice Day seems to have aroused no little resentment abroad, and its repercussions are to be heard in nearly every capital of Europe. That disarmament is desirable is not denied, but none of the more important powers seem to be willing to take the lead in abandoning its preparations for war, or the heavy taxation which such preparations involve.

A feeling of vague uneasiness is the result, but it is to be hoped that it will be dissolved as the Christmas season brings men to realize that its message of "peace on earth" has an economic value as well as a sentimental appeal.

WHAT'S DOING IN INDUSTRY

WHILE no appreciable effect on machine tool buying was noticed before the election, several centers now report a speeding up in sales due to orders placed after Mr. Hoover's election was assured. At the present time conditions are satisfactory all over the country. Cincinnati reports an appreciable livening up of the market in both local and outside territories. Renewed buying and inquiry is noted in Milwaukee, where the industrial payroll is the largest in the history of the city.

IN CLEVELAND sales continue on an even plane, and November business is expected to equal that of October. November is also expected to be a good month in New England. Business is at a high level in Chicago, and there, as elsewhere, the indications are that the market will be sustained for some time. Conditions in Buffalo are considered satisfactory, also.

PHILADELPHIA metal-working plants are all busy, and a shortage of labor is in evidence. This condition is true of nearly every center of the country today, and those who feel the pinch most are the machine tool builders, who are facing a delivery problem with many orders ahead and insufficient labor to produce the machines.

IN DETROIT a fairly high level of activity is noted despite the fact that the automotive plants are curtailing production in view of early model changes. Because of these changes, however, automotive buying of equipment still features the market in many centers, such as Cleveland.

The Industrial Review

Weekly progress of the machinery and machine tool business

THE following reports, gathered from the various machinery and machine tool centers of the country, indicate the trend of business in these industries and what may be expected from the future:

CLEVELAND

Little change is noted in the local machinery and machine tool market for the past two weeks. Sales continued on a steady, even plane that has characterized the market for the past two months. Orders closed for the first half of November indicate that the volume will equal that of the previous month. Closing of a few large lists are reported, but the average business consists of one and two lots. The automotive and aeronautical industries are well represented in the buying. Inquiries are holding up fairly well with date of delivery an important factor.

Stock shares of machine tool companies which sank in the after-war slump are well on the road to recovery again. National Acme has been looming up for some time due to increased earnings and continued good business prospects. Stock of the Cleveland Automatic Machine Co. has reached the highest point attained since 1923. The latter concern is booked solid until February 1. Production is running about three times as large as a year ago. Foote-Burt A and preferred shares have established record highs on the local exchange. Operations at this plant are running high and it is understood they have enough business on hand to insure maximum production until February.

BUFFALO

Conditions in the machine tool trade in the Buffalo district are highly satisfactory at the present time. Final figures show that October was an exceptionally good month and current business for the month of November is coming in at about the same rate as in October.

Inquiries are good and some houses report them better since election. It is generally believed, however, that election had less effect on business in this field this year than ever before. Some predict that business need not be expected to be much better until after the first of the year when it will be expected to strike a really fast stride, the fastest since the war.

In the electrical equipment field conditions seem even more highly satisfactory than in the machine tool field but the business tone and anticipation of future business is about the same. Conditions in the contractors' equipment field are quiet.

DETROIT

The machinery and machine tool market in the Detroit district is maintaining a fairly high level in spite of the slight seasonal decline that has been noted in the automobile industry. A large number of orders for all types of equipment are being received and the general optimism of the trade is high.

The Ford Motor Co. has been producing more than 6,000 cars a day and the total is constantly mounting. More work is being let out to the small shops, all of which are still busy. Hupp, Graham-Paige, Hudson, Chevrolet and Buick are going forward rapidly. The Fisher Body Co. is expanding and developing its plants in Pontiac as are other units of the General Motors there.

From every angle there is some indication that the general condition of prosperity that exists here is a sound one. Some of the dealers predict that next year will be still more prosperous. This year is already far ahead of 1926 in sales and before January will have advanced still more. The factors in next year's business are hazy of course but it has been asserted by at least one responsible dealer, however, that the revenue, to the machinery trade, will be less next year than this. It is also believed here that the production of airplanes in Detroit will be a big feature in the equipment business within the next few years.

Employment is dropping but is still very high. Automobile manufacturers are curtailing production in preparation for the general alterations that precede the annual automobile shows.

CHICAGO

Business in machine tools for the first half of November continues to be maintained at a high level. Such slight recession as was noted for the first week of the month apparently had no special significance other than that several orders were being held back pending election returns. The tone of the market is distinctly strong, and all signs indicate that it will remain so throughout the present year. It is not possible to point to any particular industrial development, or industry, as being the leading factor in the satisfactory situation now existing in the machinery field.

Farm implement and tractor manufacturers, together with automotive and auto accessory producers are said to be largely responsible for the high level of prosperity the machine tool industry has held for the last several months, with general industry contributing a goodly share to the total volume of trade. Nothing new in the way of inquiries is reported from railroads, and it is not believed anything important from this source will materialize until after the middle of December.

Business in used tools holds up well, the demand for millers and grinders in first-class condition being the most noticeable feature in this market.

NEW ENGLAND

A revival of brisk buying, which got underway during the past week is expected to make November comparable with other banner months of this banner year. The week produced several fine orders, making the period the most active of the month. Included in the orders noted among dealers and machine tool manufacturers were listed a profiling machine, radial drill, shaper, three jig boring machines, presses, high-speed lathes and an assortment of bench tools, the latter order for second-hand equipment.

With the last month of the year approaching, all lines of industry are nicely occupied. Overtime schedules are becoming the rule rather than the exception in many cities, and there is no further likelihood of a let up previous to inventory time. The problem of many machine tool builders is to organize working forces to that fine point of efficiency that will speed up production to meet urgent delivery requirements.

The trade is looking forward to and preparing for an increasing demand for machinery and machine tools from the aeronautical industry. Connecticut has been exceptionally prominent in anticipating the development of this industry, while Massachusetts has not been far behind. The de Havilland interests will shortly take equipment for the manufacturer of Moth planes at Lowell, Mass. The United States Cartridge Company's plant will be utilized for the purpose.

MILWAUKEE

Renewed interest in the buying of metal-working equipment is again discernable, and there has been a substantial increase in inquiry during the past ten days to two weeks to give promise of a well-sustained tool market for the remainder of the year. While there was not at any time a sudden drop in orders, it is true that the unusual briskness of August and September, which was evident also for the greater part of October, experienced a slight let-down during the immediate pre-election period. Since that time a gradual upswing has been noticeable, and it appears to be gaining momentum.

There probably never before has been an election year in which the manufacturing activity has been affected to so slight a degree as this year, and the absence of disturbances of production and payrolls at so critical a time is accepted as the basis for a relatively excellent outlook. As before, the buying of equipment covers virtually every line of metal-working industry, and this is regarded as a most satisfactory condition.

Local equipment manufacturers continue to operate at the highest point known in time of peace, while the industrial payroll of Milwaukee industry is the largest ever known, in the face of a continued shortage of machine shop labor. Despite the heavy production of machine tools, the development of new business from day to day is such that most makers remain behind on deliveries, while buyers are clamoring for equipment. This is particularly true of milling machines, one of the principal products of this manufacturing center.

CINCINNATI

Machine tool manufacturers in the Cincinnati district report that in the past week there has been an appreciable livening up of the general market. The majority report an increase in sales in the period, especially makers of large tools, and in no case was it reported that business had fallen off. Looking into the future, there are some who expect that business will decline to some extent as the end of the year approaches, but there are many who expect sales to hold at the present level, or even increase, through the remaining weeks.

Sales agents report that the market in local and adjacent territory is showing a tendency to grow livelier and state that the sales of the past week have been very satisfactory. In this branch of the trade the prevailing opinion is that there will not be an end-of-the-year lull.

In the week the great majority of the orders booked were for single tools, well scattered as to source. Purchases made by automobile manufacturers and railroads were confined to single tools. A few small export orders are reported, these being from Europe and South America. A very large order was reported by a manufacturer of planers.

Inquiries came in freely during the week from all parts of the country. Scattering inquiries came from automobile makers, railroads and industrial users.

Manufacturing conditions are favorable

in every way, but a shortage of skilled labor is developing as the demand increases. Efforts of manufacturers in other cities to recruit skilled mechanics from this vicinity are looked on with great disfavor.

NEW YORK

Several instances of orders for machine tools delayed until after the presidential election were noted in the New York market. One dealer reported a large number of orders in the past week, among them one for a considerable number of machines, and predicted that November would be the month of highest activity this year. Another firm also stated that several big orders had been placed immediately after the election, while a third reported the most active week in some months. To offset these optimistic statements, another dealer found the week the slowest in some time. In every case, however, it was stated that a large amount of business was outstanding, and it was felt that the year would be rounded out with considerable activity among local buyers.

The General Electric Co. bought some machines and issued inquiry for others. Purchases were made also by the Wright Aeronautical Corporation to round out earlier ones, and buying on a large scale is anticipated in the near future. No railroad buying of any account has been noted for some time, and no action is expected on the list asked for by the Norfolk & Western R.R. until after the first of the year. Railroad buying in Chicago was reported at the general office of a company serving this field.

The Pratt & Whitney Co. sold during the week: eight lathes, a jig borer, two die sinkers, a bench lathe, a thread miller, three vertical shapers, a vertical surface grinder, a cutter grinder and two centering machines. The Niles Tool Works Co. sold a 4-spindle mud-ring drill to a Western railroad, and a car-box borer to a company in the Middle West. The machinery division of the company sold a 1¼-in. Acme forging machine, six Cincinnati tappers, a Ransom grinder, an Aurora drill, a 4¼-ft. Morris radial drill, and an 18-in. Boye & Emmes lathe.

PHILADELPHIA

Requests for skilled workers in the machinery and machine tool trade from various sections throughout the Philadelphia area, featured the trade situation in this market during the last two weeks.

Many of the industrial plants are working close to 100 per cent of capacity, and although there were no large orders during the last two weeks, heads of sales departments and sales agents throughout the market reported business on a satisfactory level.

Industrial establishments from Eastern centers have been making inquiries as to prices and delivery for heavy equipment, including borers, planers and gear cutters. There was a noticeable lack of any such inquiries from railroads, although the automotive trade has made a few inquiries. The situation was regarded favorably by those receiving the inquiries as a large percentage of them came from general industrial lines.

The Reading Co. announced it plans to place a $20,000,000 electrification program under way within the next few months that would substitute electricity for steam power on the company's suburban lines, the work to start not later than March 1. Eventually the company expects to extend the electrification of its lines to New York. This announcement follows a statement two weeks ago by the Pennsylvania Railroad Co. that it will soon get under way the electrification of its line from Philadelphia to New York.

Industrial leaders were interested in the announcement that the Midvale Co., manufacturers of steel parts, which is controlled by the Baldwin Locomotive Works, increased its dividend rate from 50 to 75 cents a share a quarter. Announcement by the Reading Co. said the machine shops will soon be placed on a full-time basis.

Business No Longer "Private"

(Continued from page 828a)

it seems to me, to make of itself more than an accurate chronicler of events. The business publication that fully grasps its present opportunity will readjust itself to these changing conditions and interpret them. It will look beyond the things of today and point the way to sane procedure for tomorrow. It will serve as a clearing house of ideas. It will evolve new ideas.

"It will not lull its readers into a false security by continuous sounding of the note that all's well in the best possible of business worlds if and when it knows that far reaching change is just around the corner. It will, rather, keep its readers alert and stimulate their individual thinking by candid discussion of facts and new ideas and changes it sees in the offing. It may, now and then, have an unpalatable truth to tell and the telling may make some of its readers angry. They may even write in and 'stop their subscriptions.' But even an angry subscriber can't turn aside the current of events, nor make black white; but if the watchman in the tower be asleep then there is indeed none to warn of approaching danger.

"Above all else it will seek out those flaws and deteriorations within business and industry, those bad practices which tend to undermine and destroy the good name of business, and will vigorously counsel measures—measures to be undertaken by business itself—to scotch these evils. It will team up effectively with organized business—not to take the place of organization—but to give to business organization the immense weight of its influence in the great task of fulfilling the obligations which the public has every right to expect business fully to assume and as fully to discharge."

Engineering Laboratory Dedicated at Princeton

A notable group of engineers and educators gathered in Princeton, N. J., on November 15 to take part in the ceremony dedicating the new engineering laboratory of Princeton University. President John Grier Hibben, members of the board of trustees and of the faculty, and delegates from other educational institutions and engineering societies formed an academic procession that started from Nassau Hall and arrived at the entrance hall of the new building at 12:30. There, the architect of the building, Chas. Z. Klauder, presented the key to President Hibben who accepted it with a short address on the Princeton conception of engineering education. Dean Arthur M. Greene, Jr., of the engineering school was the other speaker. He outlined the course of study and explained how the building had been laid out to meet the needs of the course.

The delegates were entertained at luncheon at the Princeton Inn, where the speakers were Carlton S. Proctor, president of the Princeton Engineering Association; Dean Augustus Trowbridge of the graduate school; and Dean Dexter S. Kimball of Cornell University. President Hibben presided.

Mr. Proctor explained the function of the alumni body of which he is the president and told of its efforts and achievements in behalf of the university and the engineering school. It has worked long and hard to revise the engineering course and secure the adequate building and equipment just completed.

In his remarks Dean Trowbridge pointed out that scientific research has placed science and industry far ahead of politics, economics, ethics, and history. Rather than call a halt on scientific advancement until other phases of human endeavor can catch up, as suggested by an English bishop, it is time for them to apply the same principles of open-minded investigation and study until they can close the gap.

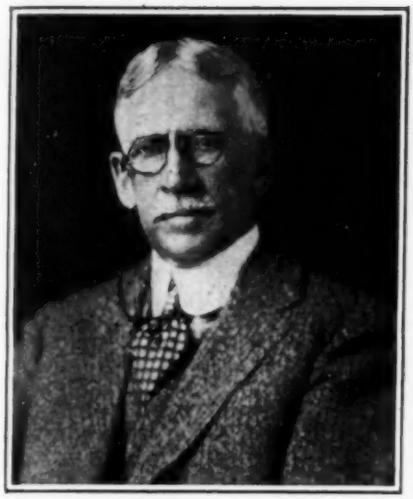
As an example of his contention that the curve of progress is pushing steadily onward and upward at a rapid rate, Dean Kimball said that the first lathe could be carried about by one man. Standard lathes today will swing 10 ft. and take work 40 ft. long between centers. The Corliss engine at the exposition of 1876, an enormous machine for those days, developed 1,400 hp. Today a turbo-generator of 208,000 kw. is under construction, and the end is not yet. Power per capita in the civilized nations is found to vary directly as the national wealth.

Syracuse Chilled Plow Co. Announces Vacation with Pay for Employees

Factory employees of the Syracuse Chilled Plow Co., Inc., Syracuse, N. Y., hereafter will receive annual vacations with pay, according to a plan recently announced by the directors of the company. The plan becomes effective at once, the first vacation periods falling in the year 1929. All regular employees, who have two or more years of service will be eligible to a vacation with pay. The amount will be based on the employees annual earnings and will vary with length of service.

Frederick K. Copeland Dies

Frederick Kent Copeland, president of the Sullivan Machinery Co., Chicago, since 1892, died at the age of 73 at Claremont, N. H., on Nov. 10 following an attack of appendicitis while on a visit to the company's Eastern works at Claremont. Mr. Copeland graduated from the Massachusetts Institute of Technology in 1876, and spent a number of years in mining work. He helped organize the Diamond Prospecting Co. and became its president. In 1892 the company merged with the Sullivan Machinery Co., which Mr. Copeland then headed. He was a member of numerous



Frederick Kent Copeland
Late president of the Sullivan Machinery Co.

engineering societies, including the American Society of Mechanical Engineers, and was past president of the Engineers Club of Chicago, the Western Society of Engineers, and of the National Metal Trades Association. In the recent presidential campaign, he was chairman of the Chicago Engineers' Committee for Herbert Hoover. Mr. Copeland was considered a leader in his field and his counsel was sought frequently.

Business Items

Joseph T. Ryerson & Son, Inc., Chicago, has taken on the line of portable electric tools made by the Millers Falls Co., Millers Falls, Mass.

The Peterson Machine Co., of Brooklyn, N. Y., has changed its address from 34 East 29th St. to 603 Degraw Street. The concern does experimental and production work.

The Boye & Emmes Machine Tool Co., of Cincinnati, has appointed the Cadillac Machinery Co., 414 Fisher Bldg., Detroit, as agent for its line of lathes in that territory.

Business received by the Federal Screw Works, Detroit, amounted to $340,000 in October, or 40 per cent greater than any previous month in the history of the organization.

The Foster-Johnson Reamer Co. of Elkhart, Ind., has filed papers with the secretary of state in Indianapolis evidencing the redemption of $8,300 of the company's capital stock.

The W. J. Savage Co., Knoxville, Tenn., manufacturer of steel parts and a dealer in machinery and mill supplies, has been sold to a group of investors headed by W. M. Fulton. The sale price was about $250,000. The company was founded in 1904.

A new acetylene plant was put in operation at South Charleston, W. Va., by the Prest-O-Lite Co., of New York, N. Y., on Oct. 29. J. J. Robinson is in charge of the plant and S. P. Murphy, with headquarters in Cincinnati, is district superintendent.

Petty & Wherry, Inc., 50 Church St., New York, N. Y., have been appointed metropolitan distributors for the Buckwall Engineering Co., of Brooklyn, N. Y., manufacturer of sprocket wheels for material handling equipment.

The R. Hardesty Manufacturing Co., Denver, Colo., which was named recently as one of the companies that sold its can business to the Continental Can Co., will retain its plant and continue the manufacture of irrigation machinery. The can line was only about one-fourth of its output.

Letters of incorporation have been issued to the J. V. Patten Co., DeKalb Ave. and Hervester St., Sycamore, Ill. The company will manufacture and deal in tanks, heaters and cast-iron products. Capital $100,000. Incorporators: Floyd E. Brower, J. V. Patten, D. C. Patten.

The Todd Co., Inc., Rochester, N. Y., maker of devices for safeguarding financial transactions, has adopted the five-day work week. The same scale of wages prevails as on the six-day week. Other plants of the company at New York, Chicago, Denver and Dallas are continued on the old basis pending the outcome of the experiment at Buffalo.

The Anaconda Copper Mining Co., through its subsidiary, the American Brass Co., of Waterbury, Conn., is rebuilding its electrical cable plant at Hastings, N. Y., for the production of power cable of all types. The Hastings plant was originally operated under the name of the National Conduit & Cable Co., and the plant is one of the largest copper cable mills in the country.

The I. P. Morris Corporation of Philadelphia, and De La Vergne Machine Co., formerly of New York, have consolidated their operations in Philadelphia under the name of I. P. Morris & De La Vergne, Inc. The I. P. Morris Corporation is controlled by Cramp-Morris Industrials, Inc., which in turn is controlled by American Ship & Commerce Corporation.

Articles of incorporation have been filed with the secretary of state in Indianapolis by the Indiana Forge and Machine Co. of East Chicago, Ind. The corporation has an initial capital stock of $15,000 common and $10,000 preferred and is formed to manufacture machines and tools of all kinds. The incorporators are Edwin J. Carlson, L. E. Larson, Emily Carlson and Judith Larson.

J. D. Adams & Co., Indianapolis, Ind., manufacturers of road machinery, plan an addition to the plant at 217 South Belmont Ave. The new building will conform in structure to the present one-story building and will cost, exclusive of equipment, about $30,000. According to officials of the company, it is hoped eventually to add 71,000 sq.ft. space to the plant. The present proposed building will contain about 51,000 square feet.

The American Brass Co., Waterbury, Conn., has acquired the Brown's Copper & Brass Rolling Mills' property at New Toronto, Canada. In addition the American company has purchased an adjoining 12-acre piece of land from S. O. Murchison. C. F. Hollister and M. S. Moss, officials for the Anaconda interests, negotiated the purchases. Since 1922 the American Brass Co. has leased the Brown's mills and operated it as a Canadian unit.

American Cirrus Engine, Inc., has been organized to manufacture and sell the Cirrus straight-line, air-cooled airplane motor in this country. A syndicate of Wall Street bankers and business men headed by Campbell, Peterson & Co., Inc., 84 William St., New York, N. Y., has exercised an option for acquisition of the rights which had been held by Campbell, Peterson & Co., Inc. Production of the motor will be in quantity in five months.

Articles of incorporation have been filed by the Kokomo Economy Tool Corporation, of Kokomo, Ind. The corporation has an initial capital stock of 2,500 shares of no-par value common stock and is formed "to manufacture, distribute and sell all kinds of machine tool equipment, machinery, tools and machinery supplies." The incorporators are John E. Fredrick, A. V. Conrad, Rulo S. Conrad, O. H. Buck, J. Paul Johnson, Franklin D. Miller and Alton G. Seiberling. Mr. Fredrick is well known to the steel and machinery trade and Mr. Seiberling formerly was vice-president of the Haynes automobile organization.

Indianapolis is to have its first major aircraft manufacturing unit shortly. This announcement was made by G. M. Williams, president of the Marmon Motor Co. Mr. Williams made public tentative plans for the formation of a company for the development and manufacture on a large scale of commercial airplane engines and later of airplanes. Although few details of the new organization were made public, it was announced that H. H. Brooks, who has been associated with the Marmon company for a long period as general sales director, would head the new company. It also was stated that it was likely Col. Howard Marmon, while retaining his position as vice-president in charge of engineering at the Marmon plant, will be responsible for the engineering development of the airplane engine project.

Personals

ISHAM KEITH, formerly in the New York sales office of the Niles-Bement-Pond Co., has been appointed sales agent in the Syracuse (N. Y.) territory.

J. A. HART, purchasing agent of the Baldwin Locomotive Works, Eddystone, Pa., has been named general purchasing agent, succeeding W. A. Russell, vice-president in charge of purchases.

MESSRS. AINSWORTH and TAYLOR, respectively managing director and supervisor of engineering and production of Hotchkiss & Al, Paris, France, are spending a few weeks in the country visiting representative plants.

A. J. GATES has been made chief sales executive of the Baker-Raulang Co., Cleveland, maker of industrial trucks, tractors and cranes. Mr. Gates has been associated with the company for the past ten years as representative in Ohio and Michigan. Previous to that he was sales engineer with the General Electric Company.

FRANK J. BAUMIS has resigned as president of the Shaw Crane-Putnam Machine Co., Inc., and as vice-president and director of Manning, Maxwell & Moore, Inc., to become associated with the Ingersoll-Rand Co., New York City, beginning Dec. 1. His activities will be connected with the oil-electric locomotive of the Ingersoll-Rand concern.

FREDERICK S. BLACKALL, JR., has been appointed general manager of the Taft-Peirce Manufacturing Co., Woonsocket, R. I., to succeed his father, who died recently. He is also assistant secretary of the company and a member of the board. For the last six years he has been active in the management of the affairs of the company. Mr. Blackall is a member of the Gage Design Committee.

Obituaries

HORACE J. CAULKINS, 36, secretary-treasurer of the Production Tool Co. of America, Detroit, died on Nov. 1, from an attack of appendicitis.

VAN LOAN WHITEHEAD, 71, chairman of the board of Whitehead Bros. Co., Buffalo, manufacturer of foundry equipment, died recently as the result of an automobile accident.

Forthcoming Meetings

Society of Automotive Engineers. Production meeting, Book-Cadillac Hotel, Detroit, Mich., Nov. 22-23. Coker F. Clarkson, secretary, 29 W. 39th St., New York City.

American Society of Mechanical Engineers. Annual meeting, Engineering Societies Bldg., New York, week of Dec. 3. Calvin W. Rice, secretary, 29 W. 39th St., New York City.

Seventh National Exposition of Power and Mechanical Engineering. Held at Grand Central Palace, New York, N. Y., week of December 3.

Power Transmission Association. Annual meeting, Hotel Commodore, New York City, Dec. 6. Association headquarters, 644 Drexel Bldg., Philadelphia.

Western Metal Congress and Western States Metal & Machinery Exposition. Held in Los Angeles, Jan. 14-18, under the auspices of the American Society for Steel Treating. W. H. Eisenman, secretary, 7016 Euclid Ave., Cleveland.

The Weekly Price Guide

Rise and Fall of the Market

THE present upward movement in prices of pig iron, sheets (steel, copper and brass), babbitt metal, solder and other metallic materials, is offset by the declining trend in scrap steel, copper and brass. The market position of the old metals, accordingly, portends no immediate rise in quotations on such items as bars, shapes, plates, wire products and tin plates. Two extremes are presented in the case of pig iron and that of heavy-melting steel scrap. Pig iron is advancing rapidly, current prices being $2 per ton above those of four months ago. Heavy-melting steel scrap, on the other hand, has experienced a net decline of 75c. per ton, Pittsburgh, during the last three weeks.

(*All prices as of Nov.* 16, 1928)

IRON AND STEEL

PIG IRON—Per gross ton, f.o.b.:

CINCINNATI	
No. 2 Southern (silicon 1.75@2.25)	$19.94
Northern Basic	20.89
Southern Ohio No. 2	21.19
NEW YORK—Tidewater Delivery	
Southern No. 2 (silicon 1.75@2.25)	25.50
BIRMINGHAM	
No. 2 Foundry (silicon 1.75@2.25)	16.25
PHILADELPHIA	
Eastern Pa., No. 2x (silicon 2.25@2.75)	21.76
Virginia No. 2	27.17
Basic	20.76
CHICAGO	
No. 2 Foundry local (silicon 1.75@2.25)	20.00
No. 2 Foundry, Southern (silicon 1.75@2.25)	22.26
PITTSBURGH, including freight charge ($1.76) from Valley:	
No. 2 Foundry	19.26
Basic	19.26
Bessemer	21.26

IRON MACHINERY CASTINGS—Cost in cents per lb. of 100 flywheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight 275 lb.:

Detroit	4 50
Cleveland	5.00
Cincinnati	4.30
New York	5.25
Chicago	4.50@4.75

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the mill base in large lots.

Blue Annealed	Pittsburgh Mill Base	Chicago	Cleveland	New York
No. 10	2.00@2.10	3.35	3.25	3.90*
No. 12	2.05@2.15	3.40	3.30	3.95*
No. 14	2.15@2.25	3.45	3.35	4.00*
No. 16	2.25@2.35	3.55	3.45	4.10*
Black				
Nos. 18 to 20	2.55	3.60	3.30	4.00
No. 22	2.70	3.75	3.45	4.15
No. 24	2.75	3.80	3.50	4.20
No. 26	2.85	3.90	3.60	4.30
No. 28	3.00	4.05	3.75	4.45
Galvanized				
No. 10	2.70@2.80	3.95	3.65	4.25
Nos. 12 to 14	2.80@2.90	4.05	3.75	4.35
No. 16	2.90@3.00	4.15	3.85	4.45
No. 18	3.05@3.15	4.30	4.00	4.60
No. 20	3.20@3.30	4.45	4.20	4.75
No. 22	3.25@3.35	4.50	4.25	4.80
No. 24	3.50@3.60	4.65	4.35	4.95
No. 26	3.65@3.75	4.90	4.60	5.20
No. 28	3.90@ 00	5.15	4.85	5.45

250 to 3,999 lb.

WELDED STEEL PIPE—Warehouse discounts are as follows:

	New York Black	New York Galv.	Cleveland Black	Cleveland Galv.	Chicago Black	Chicago Galv.
1 to 3 in., butt welded	50%	36%	55½%	43½%	54%	41%
2½ to 6 in., lap welded	45%	32%	53½%	40½%	51%	38%

WROUGHT-STEEL PIPE LIST

Size, Inches	List Price per Foot	—Diameter in Inches— External	Internal	Thickness Inches
1	$0.17	1.315	1.049	.133
1¼	.23	1.66	1.38	.14
1½	.27½	1.9	1.61	.145
2	.37	2.375	2.067	.154
2½	.58½	2.875	2.469	.203
3	.76½	3.5	3.068	.216
3½	.92	4.0	3.548	.226
4	1.09	4.5	4.026	.237
4½	1.27	5.0	4.506	.247
5	1.48	5.563	5.047	.258
6	1.92	6.625	6.065	.28

SEAMLESS STEEL TUBING—Following net prices are for seamless mechanical tubing, cold drawn, round, .10 to .30 carbon, at New York warehouse in lots of less than 100 ft. or 100 lb.:

——Thickness—— Decimal	B.w.g. and Fractions	Outside Diameter in Inches ½	⅝	¾	⅞	1	1⅛	1¼
		Price per Foot						
.035″	20	$0.15	$0.16	$0.17	$0.18	$0.19	$0.21	$0.23
.049″	18	.17	.18	.19	.20	.21	.23	.25
.065″	16	.19	.20	.21	.22	.23	.25	.27
.083″	14	.20	.22	.23	.24	.25	.27	.29
.095″	13	.21	.23	.25	.26	.27	.29	.31
.109″	12	.22	.24	.26	.27	.28	.30	.32
.120″ or .125″	11	.23	.25	.27	.28	.29	.31	.33
.134″	10	.24	.26	.28	.29	.30	.32	.34

MISCELLANEOUS—Warehouse base prices in cents per lb.:

	New York	Cleveland	Chicago
Spring steel, light*	4.50	4.65	4.65
Spring steel, heavier	4.00	4.00	4.00
Coppered Bessemer rods	6.05	6.00	6.20
Hoop steel	4.50‡	4.00	4.15
Cold rolled strip steel	6.25	6.00	6.10
Floor plates	5.10‡	5.30	5.00
Cold drawn, round or hexagon†	3.40	3.65	3.60
Cold drawn, flat or square†	3.90	4.15	4.10
Structural shapes	3.30‡	3.00	3.10
Soft steel bars	3.25‡	3.00	3.00
Soft steel bar shapes	3.25‡	3.00	3.00
Soft steel bands	4.00‡	3.65	3.65
Tank plates	3.30‡	3.00	3.10
Bar iron (2.75 at mill)	3.24	3.00	3.00
Drill rod (from list)	60%	55%	50%

*Flat, $\frac{3}{16}$@½-in. thick. †Cold finished steel, shafting and screw stock. ‡250 to 3,999 lb., ordered and released for shipment at one time.

Electric welding wire, New York, $\frac{3}{32}$, 8.35c.; $\frac{1}{8}$, 7.85c.; $\frac{5}{32}$ to $\frac{1}{2}$, 7.35c. per lb.

METALS

Warehouse Prices in Cents Per Pound for Small Lots:

Copper, electrolytic, New York			16.75
Tin, Straits, pigs, New York			51.50
Lead, pigs, E. St. Louis	6.20	New York	8.00
Zinc, slabs, E. St. Louis	6.25	New York	7.75

	New York	Cleveland	Chicago
Antimony, slabs	13.50	14.75	14.25
Copper sheets, base	25.00	25.00	24.25
Copper wire, base	21.62½	21.25	17.50*
Copper bars, base	23.50	23.50	23.25
Copper tubing, base	26.37½	26.37½	25.75
Brass sheets, high, base	20.50	20.50	20.00
Brass tubing, high, base	25.37½	25.37½	24.87½
Brass rods, high, base	18.25	18.25	17.75
Brass wire, high, base	21.00	21.00	20.50

*At mill.

Shop Materials and Supplies

METALS—Continued

	New York	Cleveland	Chicago
Aluminum ingots, 99%	25.00*	24.30	24.30
Zinc sheets (casks)	10.00@10.50	11.00	10.01
Solder (½ and ½)	35.00	33.00	31@34
Babbitt metal, delivered in case lots, New York, cents per lb.:			
Genuine, highest grade			68.00
Commercial genuine, intermediate grade			53.00
Anti-friction metal, general service			31.50
No. 4 babbitt (f.o.b.)			12.25
Nickel, f.o.b. refinery, Bayonne, N. J., cents per lb.:			
Ingots 35.00	Electrolytic 37.00	Shot	36.00

*Delivered.

SPECIAL NICKEL AND ALLOYS—Price in cents per lb., f.o.b. Huntington, W. Va.:

Full finished nickel sheet (base)	52.00
Cold rolled nickel sheet (base)	60.00
Hot rolled nickel rods, Grade "A" (base)	45.00
Cold drawn nickel rods, Grade "A" (base)	53.00

Base price of Monel metal in cents per lb., f.o.b. Huntington, W. Va.:

Shot	28.00	Hot rolled rods (base)	35.00
Blocks	28.00	Cold drawn rods (base)	43.00
Cold rolled sheets (base)	50.00	Full finished sheets (base)	42.00

OLD METALS—Dealers' purchasing prices in cents per pound, f.o.b. cars, depending on quantity:

	New York	Cleveland	Chicago
Crucible copper	14.00 @14.25	13.75	12.75@13.25
Copper, heavy, and wire	13.25 @14.00	13.00	12.12½@12.50
Copper, light, and bottoms	12.00 @12 37½	11.00	11.00@11.50
Heavy lead	5.25 @ 5.37½	6.25	4.75@ 5.25
Tea lead	3.50 @ 4.00	4.25	3.75@ 4.25
Brass, heavy, yellow	7.87½@ 8.12½	8.50	8.00@ 8.50
Brass, heavy, red	9.75 @ 9.87½	....	10.25@10.75
Brass, light	6.25 @ 6.75	6.75	6.75@ 7.25
No. 1 yellow rod turnings	9.00 @ 9.50	9.50	8.75@ 9.25
Zinc	3.25 @ 3.50	3.25	3.00@ 3.50

TIN PLATES—Charcoal—Bright—Per box.

		New York	Cleveland	Chicago
"AAA" Grade:				
IC,	14x20	$12.10	$11.95	$11.50
"A" Grade:				
IC,	14x20	9.70	9.90	9.50
Coke Plates—Primes—Per box				
100-lb.,	14x20	6.45	6.10	7.00
Terne Plates—8-lb. Coating—Small lots—Per box				
IC,	14x20	7.75@8.00	7.00	7.50

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.*	$0.10@0.13½	$0.16	$0.15
Cotton waste, colored, per lb.*	.09@ .13	.12	.12
Wiping cloths, washed white, per lb	.16	38.00 per M	.17
Sal soda, per lb	.02	.02	.02
Roll sulphur, per lb	.027	.03½	.04
Linseed oil, raw, in 1 to 4 bbl. lots, per lb	.112	.11	.107
Cutting oil, about 25% lard, in 5 gal. cans, per gal	.65	.60	.60
Machine oil, medium-bodied (55 gal. steel bbl.) per gal	.30	.36	.36
Belting—Present discounts from list in fair quantities (½ doz. rolls).			
Leather—List price, 24c. per lin.ft. per inch of width for single ply.:			
Medium grade	30-10%	30-10%	35%
Med. grade, heavy wgt.	30-5%	30-5%	30%
Rubber transmission, 6-in., 6 ply, $1.83 per lin.ft.:			
First grade	50%	50-10%	50%
Second grade	60%	60-5%	50-10%

*All waste in bale lots.

Comparative Warehouse Prices

New York	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars	per lb.	$0.0325	$0.0325	$0.0324
Cold drawn shafting	per lb.	.034	.034	.04
Brass rods	per lb.	.1825	.175	.16
Solder (½ and ½)	per lb.	.35	.3425	.3575
Cotton waste, white	per lb.	.10@.13½	.10@.13½	.10@.13½
Disks, aluminum oxide mineral, cloth, No 1, 6-in. dia	per 100	3.59	3.59	3.10
Lard cutting oil	per gal.	.65	.65	.65
Machine oil	per gal.	.30	.30	.27
Belting, leather, medium	off list	30-10%	30-10%	35%
Machine bolts, up to 1x30 in., full kegs	off list	50%*	50%*	50%*

*List prices as of April 1, 1927.

MISCELLANEOUS—Continued

	New York	Cleveland	Chicago
Abrasive materials—Standard grade, in sheets 9x11 in., No. 1, per ream of 480 sheets:			
Flint paper	$4.05	$4.29	$4.29
Emery cloth	20.22	20.97	20.97
Disks, aluminum oxide mineral, 6 in. dia., No. 1, per 100:			
Paper	2.04	2.04	2.04
Cloth	3.59	3.59	3.59
Fire clay, per 100 lb. bag	1.00	.75	.75
Coke, prompt furnace, per net ton	Connellsville, 2.85@3.00		
Coke, prompt foundry, per net ton	Connellsville, 4.00@4.50		
White lead, dry or in oil	100 lb. kegs	New York, 13.25	
Red lead, dry	100 lb. kegs	New York, 13.25	
Red lead, in oil	100 lb. kegs	New York, 14.75	

SHOP SUPPLIES

Discounts from new list dated Apr. 1, 1927, applying on immediate deliveries from warehouse stocks in New York and vicinity:

	Full Kegs or Cases
Machine bolts, square heads and nuts:	
Up to ¾ x 6-in.	55%
Larger up to 1 x 30-in.	50%
1⅛ and 1¼ in. dia.	35%
Carriage bolts:	
Up to ½ x 6-in.	55%
Larger sizes	50%
Coach and lag screws:	
Up to ½ x 6-in.	55%
Larger sizes	50%
Tap bolts, hexagonal heads	40%
Nuts:	
Hot pressed, square and hexagonal, blank or tapped, up to 1-in., incl.	55%
Cold punched, square and hexagonal, blank or tapped, up to 1-in. incl.	55%
Semi-finished, hexagonal, tapped, in packages, all sizes	40%
Case hardened, hexagonal, tapped, in packages, all sizes	30%
Washers: Deduct from list, per 100 lb	$3.50*
Rivets, button and cone head:	
Small, including ⅞-in. dia	50-10%
Large (base) per 100 lb. net	$5.00†

Note—For less than full package quantities on bolts, screws, hot-pressed and cold-punched nuts, add extra of 10 per cent to list.
*Broken keg lots, $1.50 off list. †Broken keg lots, $6.50 net.

Machine Requirements and Industrial Construction

Equipment Wanted

Calif., Los Angeles—A. E. Sanford, 811 Tularosa Dr.—two bench lathes, 8 or 9 in. swing and three punch presses, 10 to 40 ton capacity.

Calif., Mare Island (sta. Vallejo)—Bureau of Yards & Docks, Washington, D. C.—electrically operated revolving hammerhead crane, with capacity of 5 tons at a radius of 90 ft. and 10 tons at a radius of 50 ft. at Navy Yard here.

Ill., Chicago—Chicago Bridge & Iron Co., 1305 West 105th St.—one 10 ton overhead electric crane.

Mich., Detroit—Frederick Colman & Sons, 7250 Central Ave.—milling machine.

Mich., Detroit—Gorham Tool Co., 2206 12th St.—miscellaneous machine shop equipment for proposed 1 story, 120 x 125 ft. tool factory. Estimated cost $50,000.

Mich., Detroit—Square D. Co., 6060 Riverard St.—equipment for the manufacture of safety switches for proposed 3 story addition electrical appliance factory on Russell St. Estimated cost $100,000.

Mich., Detroit—Tool Engineering Co., 5842 Epworth Blvd.—drill press.

Mich., Pontiac—American Forging & Socket Co.—power hammers for proposed 1 and 2 story, 55 x 80 and 100 x 125 ft. shop on Branch St. Estimated cost $55,000.

Mich., Pontiac—Machine Specialty Co., Main St.—machine equipment for proposed 2 story, 36 x 100 ft. machine shop. Estimated cost $40,000.

O., Toledo—Industrial Steel Casting Co., Millard Ave.—general foundry equipment including cranes, molding machines, etc. for proposed 1 story, 140 x 180 ft. plant. Estimated cost $200,000.

Opportunities for Future Business

Ala., Birmingham—Stockham Pipe & Fitting Co., 4600 10th Ave., awarded contract for a 2 story, 104 x 251 and 60 x 95 ft. factory. Estimated cost $150,000.

Ala., Leeds—Kelly Stove & Range Co., R. J. Kelly, Pres., recently incorporated, plans the construction of a 160 x 300 ft. foundry and machine shop.

Calif., Berkeley—Neilson Steel Aircraft Corp., Second and Camelia Sts., awarded contract for first unit of factory at Second and Camelia Sts. Estimated cost $15,000.

Colo., Colorado Springs—Imblum Aeronautical Co., 410 West Fourth St., Pueblo, and Colorado Springs Chamber of Commerce, are having preliminary plans prepared for an airplane engine factory near Alexander airport here. Estimated cost $250,000.

Colo., Pueblo—Colorado Fuel & Iron Co., W. A. Maxwell, Prod. Mgr., will build a plant for treating and concentration of iron ore here, also one at Sunrise, Wyo. Estimated cost $100,000 each.

Ill., Chicago—Foote Bros. Gear & Machine Co., 213 North Curtis St., manufacturers of cut gears, plans a 1 story addition to plant at 13th St. and Cicero Ave.

Ill., Chicago—General Engineering Works, 340 West Huron St., manufacturers of screw machine products, is having plans prepared for the construction of a 1 story factory. Weiss & Niestadt, 53 West Jackson Blvd., Archts. Noted Sept. 27.

Ill., Chicago—Stewart-Warner Speedometer Corp., 1828 Diversey Blvd., had plans prepared for a 12 story factory at 1812 Diversey Blvd. Estimated cost $300,000. L. B. Hallberg, 116 South Michigan Ave., Archt.

Ill., Mount Vernon—J. P. Devine Co., 1372 Clinton St., Buffalo, N. Y., manufacturers of vacuum drug apparatus, and Mount Vernon Chamber of Commerce, are having plans prepared for the construction of a plant here. Estimated cost $600,000.

Me., South Portland (br. Portland)—Hunnewell Estate, c/o Edwards Sales Co., 443 Congress St., Portland, Archt., will soon award contract for a 1 story repair and service garage on Main St., here. Estimated cost $45,000. Noted Oct. 11.

Mass., Chelsea (Boston P. O.)—Everett Ave. Auto Parts Co., 234 Everett Ave., awarded contract for a 1 story, 45 x 100 ft. machine shop. Noted Oct. 11.

Mass., Dedham—New York, New Haven & Hartford R.R. Co., New Haven, Conn., awarded contract for the construction of a sand blasting shop and stripping shop on Sprague St. here. E. Gazel, Ch. Engr.

Mass., Haverhill—Smith Motor Car Co., 88 Main St., awarded contract for a 1 story, 100 x 135 ft. repair and service garage at 74-84 Main St. Estimated cost $45,000. Noted Oct. 25.

Mass., Milton (Boston P.O.)—M. Greenspan, 161 Devonshire St., Boston, will build a 1 story garage and repair shop at Granite Ave. and Adams St. Estimated cost $50,000. Blackall, Clapp & Whittemore, 31 West St., Boston, Archts.

Mass., Roxbury (Boston P.O.)—J. F. Morse & Co., 66 Norfolk St., will soon award contract for a 2 story repair and service garage on Norfolk St. here. Estimated cost $50,000. W. W. Drummey Inc., 80 Boylston St., Boston, Archt.

Mass., South Boston (Boston P. O.)—Terkelson Machine Co., 326 A. St., awarded contract for a 2 story factory. Noted Aug. 23.

Mo., St. Louis—B. S. Lang, c/o W. S. Frank, 901 Century Bldg., Archt., will build a 3 story, 69 x 175 ft. sales and service building at 2310-18 Olive St. Estimated cost $100,000. W. S. Frank, 901 Century Bldg., Archt.

Mo., St. Louis—Wagner Electric Co., 6400 Plymouth Bldg., is having preliminary plans prepared for 1 story, 120 x 300 ft. transformer building and 80 x 120 ft. office. Estimated cost $250,000. Condron & Post, 53 West Jackson Blvd., Chicago, Ill., Archts.

N. J., Asbury Park—Doris I. Weeden, 1001 Main St., awarded contract for a 1 story, 100 x 150 ft. auto repair and machine shop on 4th Ave. Estimated cost $40,000.

N. J., Jersey City—Liberty Auto Radiator Co., 3218 Blvd., will receive bids about Dec. 1 for a 2 story repair shop. Estimated cost $40,000. Flagg & Stades, 665 Newark Ave., Archts.

N. J., Paterson—Ajax Battery Corp., c/o J. De Rose, 119 Ellison St., Archt., will build a 1 story, 100 x 100 ft. factory at Turni and Main Aves. Estimated cost $40,000.

N. Y., Brooklyn—A. P. M. Holding Corp., L. Moss, Pres., 32 Court St., plans a 2 story, 100 x 140 ft. garage on Hoff St. Estimated cost $75,000. B. W. Dorfman, 66 Court St., Archt.

N. Y., Brooklyn—A. B. Kaplan, 26 Court St., plans a 4 story, 56 x 126 ft. garage at Quentin Rd. and East 10th St. Estimated cost $60,000. W. A. Lacerenza, 26 Court St., Archt.

N. Y., Brooklyn—Kram Realty Corp., J. Marko, Pres., 285 Madison Ave., New York, is receiving bids for a 1 story garage at Union St. and 7th Ave. here. Estimated cost $200,000. Kleinert & Klie, 250 Park Ave., Archts. Noted Nov. 1.

N. Y., Brooklyn—M. Pape, 66 Court St., plans the construction of a 100 x 189 ft. garage at Brooklyn Ave. and Rutland Rd. Estimated cost $65,000. M. Klein, 65 Court St., Archt.

N. Y., Brooklyn—D. Saladino, 1307 Dean St., will build addition to garage at Bergen St. and New York Ave. Estimated cost $100,000. F. Savignano, 6005 14th Ave., Archt.

N. Y., Brooklyn—S. Straus, 1012 Myrtle Ave., plans the construction of a 95 x 99 ft. garage at Meeker and Gardner Aves. Estimated cost $40,000. C. Goodman, 375 Fulton St., Archt.

N. Y., Great Neck—Westmoreland Holding Corp. awarded contract for the construction of a garage at 262nd St. and North Hempstead Rd. Estimated cost $60,000.

N. Y., Laurel Hill (mail Flushing)—Nichols Copper Co., plans the construction of a 58 x 278 ft. plant at Hobson and Halle Aves. Estimated cost $150,000. Private plans.

N. Y., Long Island City—Mileage Gas Corp., 2 Park Ave., New York, plans the construction of a 25 x 85 ft. garage at Vernon Ave. and 44th Road here. Estimated cost $50,000. Private plans.

N. Y., New York—Dept. of Plants & Structures, plans the construction of a 2 story, 109 x 150 ft. garage and repair shop at West Farms Rd. and 174th St. Estimated cost $120,000. Private plans.

N. Y., New York—Estate of Charles F. Hoffman, W. V. Hoffman, 258 Broadway, plans the construction of a 5 story garage at 43 East 10th St. Estimated cost $50,000. W. M. Farrar, 250 8th Ave., Archt.

N. Y., Oswego—Fitzgibbons Boiler Works, A. G. Lockett, Mgr., plans addition to plant. Estimated cost $40,000. Architect not selected.

O., Canton—Timken Roller Bearing Co., 7026 Euclid Ave., Cleveland, plans the construction of a 1 story factory at 18th and 19th Sts. here. Estimated cost $200,000. A. Hauser, Deuber Ave. N. W., Engr.

O., Cleveland—James C. Heintz, 3738 West 143rd St., manufacturers of vulcanizing machines, awarded contract for a 1 story, 80 x 156 ft. addition to factory. Estimated cost $60,000.

Pa., McKees Rocks—Pittsburgh & Lake Erie R.R., Pittsburgh and Lake Erie Terminal, awarded contract for the construction of a 1 story upholsterers and air brake shop here. Estimated cost $40,000. A. R. Rayne, Ch. Engr.

Pa., Pittsburgh—F. J. Kress Box Co., 2930 Liberty Ave., is receiving bids for a 1 and 2 story, 300 x 400 ft. factory on 28th St. Estimated cost $450,000. Private plans.

R. I., Providence—Dept. of Public Works, City Hall, will soon receive bids for the construction of a repair shop, etc. at Dexter and Whitmarsh Sts. Estimated cost $65,000. T. J. H. Pierce, City Hall, Engr.

Tenn., Cleveland—Tennessee Enamel Mfg. Co., W. B. Evans, Sterling Court, Nashville, recently incorporated, plans the construction of a plant to include machine shop, etc. for the manufacture of porcelain and vitreous enameled products, metal products, etc.

Utah, Bingham—Utah Copper Co., Salt Lake City, L. S. Cates, V. Pres. and Gen. Mgr., will build an ore reclaiming plant, here. Estimated cost $75,000. Private plans.

Ont., Hamilton—Steel Co. of Canada, Ltd., Harvey Lane, will build additions and alterations to plant. Estimated cost $7,000,000.

Ont., Oshawa—General Motors of Canada, plans addition to stamping plant, also the construction of a brake testing plant. Estimated total cost $90,000. Private plans.

Ont., Toronto—Godson Contracting Co., 203 Richmond St. W., will build a 1 story, 34 x 125 ft. machine shop on Union St. Estimated cost $40,000. Private plans.

Ont., Toronto—Lawrence Park Garage, 2637 Yonge St., will soon award contract for a 2 story, 100 x 100 ft. garage at Yonge St. Estimated cost $150,000. V. L. Morgan & Co., Dufferin St. and Rosemount Ave., Weston, Archts.

Ont., Toronto—Sangamo Electric Co., 183 George St., awarded contract for a 2 story, 40 x 100 ft. addition to factory. Estimated cost $60,000.

Ont., Windsor—Chrysler Corp. of Canada, J. D. Mansfield, Mgr., will soon award contract for the construction of a 5 story, 280 x 1,000 ft. factory on Tecumseh Rd. Estimated cost $1,500,000. Hutton & Souter, 6 James St. S., Hamilton, Archts.